NC/AC 3005

AUTOMATED NON-CONTACT INTERFEROMETER SYSTEM USER MANUAL

FOR MULTIPLE FIBER CONNECTORS & ARRAYS

ACCIS RC VERSION 3.02

For WINDOWS NT

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Rev. E

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Rev. E

CHAPTER 1 - INTRODUCTION

Congratulations on your purchase of the Norland NC/AC 3005 Automated Non-Contact Interferometer System for multi-fiber and array type connectors. With this instrument, you will now be able to see and measure sub-micron variations in the surface contours of fiber optic array connector end faces. No other instrument is so versatile (handling rough or smooth surfaces, curved or flat polish, standard or angled connectors, and fiber protrusion or undercut) while providing clear, detailed information with easy automated operation.

This manual provides detailed information of the AC 3005 and NC 3005 along with the latest ACCIS software version 3.0x, as well as detailed procedures of calibration and measuring processes. Since the operation is identical for both these systems, we will use the term NC/AC to refer to either unit. The new AC 3005 has improved electronics and a new illumination system to minimize maintenance requirements. From an operators standpoint, the only difference is the procedures for replacing lamps. Most questions that arise are answered in this manual, but if additional technical support is needed, contact our technical service department at (609) 395-1966, techsupport@norlandproducts.com, or your authorized distributor.

Be sure to fill out and send in the warranty registration card. This allows us to keep you informed about updates to the system as well as what is new for the Fiber Optic Industry from Norland Products Inc.

1.1 How It Works

The NC/AC-3005 uses a custom designed inverted microscope with a piezo-controlled Michelson's interferometric objective lens and a white light source with wavelength selective filters, as shown in figure 1. An interferometric image, with constructive and destructive interference patterns (light and dark fringes respectively), is generated by combining the light reflected off the connector end face with the light reflected off the reference mirror. These interference patterns (fringes) form a contour map on the surface with the dark fringes showing steps of ½ of a wavelength down the surface. The piezo is used to move the objective lens causing the fringes to move across the surface. By following the changes as the fringes shift across the surface, the ACCIS software is able to assign a height to every single point of the surface which gives it a complete 3D map. This interference pattern is imaged on the CCD camera in the microscope and captured by the frame grabber in the computer. For wide area connectors, the stage automatically moves to the next scan according to the information entered into the set-up menu. The Multiple Image Overlay Software pieces together multiple scans to chart the complete geometry of the entire surface.

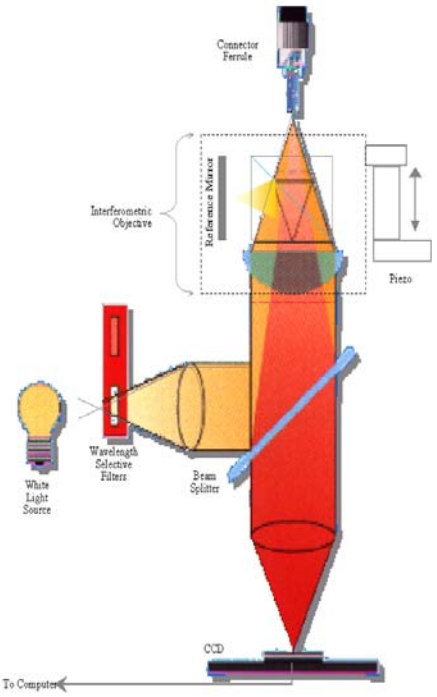


FIGURE 1

The ACCIS software included with the computer is very user friendly. The Norland NC/AC 3005 w/ ACCIS software is designed to automatically measure all the key parameters of your PC and APC polished connectors. Fiber and guide hole templates have also been integrated into the software to assure correct placement and positioning of fibers/guide holes. The resulting measurements can be printed out or exported to statistical programs for full quality control and quality conformance requirements. In addition, cross sectional profiles of the end face can be viewed and then stored or printed with the measurements. All this can be done with just a few keystrokes in the easy-to-follow, Windows program.

Please refer to the Novel Features section and the FAQ's section of this manual to familiarize yourself with all the features that separates the Norland Interferometer from its competitors.

1.2 Novel Features

Because of the complexity of multifiber connectors, Norland Products has spent years developing a novel system for measuring the end face parameters of these difficult surfaces. You, the customer, benefit from this because no other system offers so much versatility and yet is so easy to use.

One example of our versatility is that Norland Products offers a wide variety of mounts to meet the varying needs of customers. These are available for MT and MiniMT ferrules or for the complete connector.

The mounts can be separated into two types:

1. **Pin Alignment** - The latest IEC and TIA test procedures recommend measuring the angle of the multifiber connector using the guide holes of the connector as the reference with the ideal end face perpendicular to the axis of the guide holes. This is accomplished with the patented True Angle Connector Mounts from Norland Products which use integral guide pins for holding the connectors in alignment. The pins are held on a precision aperture plate at the bottom of the mount and allows viewing of connector in the region of interest. Inserting the connector simply requires sliding it into the mount onto the guide pins. This is very similar to the alignment of two connectors that are being mated in a bulkhead or in a termination. Aperture plates are also available with holes for mounting connectors with pins.

2. **Edge Alignment** - These mounts align the ferrule by using the outside edges of the ferrule similar to the way that they are held in the polishing process. The entire ferrule end face is in view and the surface can be mapped from guide hole to guide hole. Since the ideal end face should be perpendicular to the guide hole axis, this method assumes that the outside edges are parallel to the guide holes. Edge alignment mounts provide greater stability for ferrules which have stiff cables attached to them.

The ACCIS software allows for setup using the different mounts. If the entire end face is desired to be mapped, then use the Edge Alignment mount and select “Guide Holes” as the Center Locator in the Setup Menu. The computer will automatically find the guide holes and center the connector between them. With the True Angle Pin Alignment mounts, select “Template” as the Center Locator in the Setup Menu. This provides a template at the beginning of the measurement process with which to align the fibers. The computer will use this information to determine the center of the connector and the location of all the fibers.

Another example of our versatility is our ACCIS software and calibration tools. The ACCIS software allows for easy and accurate measurements with either of our True Angle or Edge Alignment mounts. To accurately measure the angle of the connector, each mount must be calibrated or leveled in reference to the mirror in the interferometric microscope.

For the MT Edge Alignment Mount, we provide a 0° metal reference standard that is polished to an accuracy of 0.01° or better. Inserting this in the mount and adjusting the interferometric mirror until it shows only one fringe provides a quick and easy calibration.

Leveling of our True Angle Pin Alignment Mounts is done almost exclusively with our custom software. The easiest and most accurate method of measuring the angle is with our Two Pass Scan. With this procedure, the connector is measured once and then rotated 180° and measured a second time. Ideally, if the mount is holding the connector perpendicular to the reference mirror, the angular

measurements would be equal but opposite signs. If the measurements are different, the program automatically calculates the range between the two measurements and divides by 2 to give the True Angle. Single Pass Scans are also possible for faster results or for angled connectors. The angle correction factor can be calculated from a two pass scan (similar to auto-leveling in the NC/AC 3000) and automatically correct for the difference in the level when Single Pass is used and "Use Angle Correction" is selected.

The ACCIS software also offers a new Fiber Masking feature to be able to measure connectors and arrays that do not have a completely filled fiber configuration. Please refer to the Configuring Data Chapter of this manual for more information regarding this feature.

Norland Products offers a wide variety of tools to provide the customer with the assurance that the NC/AC 3005 is performing to the extremely high accuracy which is expected of it. Here are a number of the tools which are available:

Magnification Calibration Standard - The magnification of the system should not change since the optics are fixed. It is still necessary to have a standard to confirm the correct performance of the system. The magnification calibration standard which is supplied with every system is an MT ferrule polished flat and to a mirror like surface. Using the magnification calibration scan mode in the setup, the NC3005 system maps the ferrule and locates the edges of the guide holes. It then calculates the center of the guide holes and calculates a magnification factor with the knowledge the distance between guide holes is 4600 microns.

NIST Traceable Magnification Calibration Reticle - The NIST Traceable Magnification Calibration offers a higher degree of accuracy as compared to the Mag. Cal. MT Standard. The 3005 software analyses the distance between the five deposited lines in the center of the reticle, which are 375 microns apart, to determine the magnification calibration factor needed to give exceptionally accurate results.

0°/8° Tilt Calibration Standard – This precision glass substrate, with NIST traceable 0º and 8º surfaces, is mounted on the tilt stage in place of the mount and is used to confirm the calibration of the micrometer controlled variable tilt stage.

0° MT Metal Reference Ferrule – The SS MT reference is a duplicate of an MT connector made of stainless steel and the end face is polished to an accuracy of 0.01° perpendicular to the sides. This reference is used with the Edge Alignment Mounts to set the mirror and the stage perpendicular to each other.

As technologies advance, you can be sure that we will continue to improve our system, offering more features and advantages for fiber optic testing. If you have any special requirements, regarding different connectors or related applications, please contact us. We are dedicated to making this product the best on the market and would be happy to provide you with solutions to your special needs.

1.3 Vibration Issues

Background: Because of their precise nature, interferometric measurements are sensitive to vibration. Vibration can occur from rotating machinery, nearby traffic, acoustic noise and a variety of other sources. Touching the instrument or the surfaces on which it sits during measurements can also affect the measurements. Symptoms of vibration are poor repeatability and can be seen as "ripples" on the computer generated images. Connecting a separate black and white monitor to the video output of the instrument can assist in determining the presence of the vibration.

Instrument placement considerations: The instrument should be placed on a solid support away from obvious sources of vibration (e.g. rotating machinery). Ideally, the instrument should rest on a separate surface so that vibrations from using the computer keyboard and vibrations from other activities are not transferred through the surface to the instrument.

Vibration Isolators: If the vibration is present even after the instrument is located on its own surface away from vibration sources, then additional vibration isolation needs to be employed. A low cost solution for vibration isolation is to place the instrument on a piece of vibration isolation material such as Sorbothane. More sophisticated vibration isolation tables are available from manufacturers such as Newport, Herzan, and Technical Manufacturing Corporation (TMC). Before purchasing equipment, a technical representative of the isolation equipment supplier should visit the site where the instrument is installed to recommend the appropriate equipment to isolate the instrument from the vibration sources present.

1.4 Specifications

***DIMENSIONS* (Measured in Inches)**	LENGTH	WIDTH	HEIGHT
Interferometer	17.0	11.0	8.3
Monitor	17.0	17.0	17.0
Computer	17.5	17.0	5.25

INTERFEROMETER - Michelson

Light Source	White Light - Tungsten Halogen
Camera	CCTV with 8.8mm x 6.6mm Sensing Area
Image Frame Size	256 x 240 Pixels
Vertical Resolution	1.1 nanometers
Magnification	45X
Lateral Resolution	7 μm
Field of View	1,600 μm^2

COMPUTER - Pentium III*

Speed	1.7 GHz*
Hard Disk	15.0 GB EIDE Drive *
Graphics Adapter	Matrox Productiva
Bios	Phoenix 4.0*
Operating System	Microsoft Windows NT 4.0
Frame Grabber	Matrox Meteor
RAM	128MB SD RAM Installed*

REPEATABILITY (RANGE)

Planar Fiber Height	0.02 μm
Flatness Deviation	0.04 μm
Differential Height	0.04 μm
Surface Angle	0.01º

PLOTTING

Contour Map	Standard
X Profile	Standard
Y Profile	Standard
3-D Isometric	Standard

DISPLAY PROPERTIES - Settings

Color Palette	16 million colors
Font Size	Large
Desktop Area	1024 x 768 pixels

*Subject to change due to improving technology

1.5 Quick Start

If you are already familiar with the Norland Interferometer or you just can't wait to start, go through the following steps to measure a connector:

I. System Preparation

II. Start the ACCIS Software. When logging onto the the ACCIS software for the first time, the security level is as an ACCIS administrator. The program is capable of handling two security levels, Manager level (ACCIS Administrators) and Operator level. If desired, the security levels can be configured according to the CONFIGURING DATA – Option Parameters – Security section in this manual. Related information can also be found in the Windows NT manual sent with computer.

III. Calibrate the machine if desired. Refer to CALIBRATION TOOLS for more detailed explanations and procedures.

IV. Measure a connector. The following are the basic procedures for measuring a connector. More detailed procedures are located in the MEASURING A CONNECTOR section of this manual.

1.Select the Interferometric Mode (Red or White). The interferometric mode is dependent on the condition of the surface of the connector. NOTE: Most array type connectors require white mode.

- Red light is used for quick analysis of smooth surfaces
- White light is used for detailed analysis of rough surfaces or surfaces with step heights (i.e. fiber protrusion)

2.Modify/load Set-Up parameters (F2 Set Up on the tool bar or Config File on the Info Bar) to control the data during the measurement process according to the connector being tested as well as the mount being used. Controlling the Set-up parameters is dependent on the security level of the user logged onto the system. ACCIS administrators can modify and save the set-up parameters according to customer specifications/requirements. Operator level users can only load set-up parameters previously saved by the ACCIS Administrators. (Refer to CONFIGURING DATA section for more detailed information.)

3.Modify Connector Parameters (Configuration → Connector) to control the data during the measurement process by indicating certain regions/fibers for removal from the data analysis. (Refer to CONFIGURING DATA – Connector Configuration for Fiber Masking for more detailed information)

4.Modify Option parameters (Configuration → Options → General/System) to control how the data is organized after the measurement process is completed. The data can be controlled to automatically save data to a specific group name and data path and/or automatically print the data upon completion of the scan. (Note: Auto printing only prints the display screens and results, it does not auto print reports.) Auto incrementing the Connector ID numbers can also be selected. Both ACCIS Administrators and Operator level users can modify the Option Parameters. (Refer to CONFIGURING DATA – Option parameters.)

5.Clean connector properly to assure accurate measurements during the scanning process. It is important to clean any residue from polishing that may have collected on the shoulder, guide pins or guide holes or endface surface. Residue will give misleading and inaccurate measurements.

6. **Insert the connector properly into the mount (Edge or Pin Alignment)** to assure accurate measurements during the scanning process.
   - For Edge Alignment mounts, insert the connector into the mount so that the epoxy well is facing the back of the interferometer and that the back shoulder of the connector is resting correctly on the reference edge (the front edge of the mount).
   - For Pin Alignment mounts, inserting the connector is dependent on the measurement method. One pass measurements must have the epoxy well facing the back of the interferometer, while Two Pass measurements start with the epoxy well facing the front of the interferometer. Pin alignment mounts have proven to be more accurate in the measurement of a connector's end face angle and follows IEC and TIA test procedures. (Refer to MEASURING A CONNECTOR for more detail on One Pass versus Two Pass measurements.)

7. **Adjust focus knob –** If there is any difficulty in bringing the connector into view, there is a focusing scale located on the right of the superstructure. Line up the major lines to bring the connector into view.
   - Red light interferometric mode - adjust the focus knob to optimize the fringe contrast over the entire surface.
   - White light interferometric mode - adjust the focus knob so the fringe contrast is optimized at the middle of the surface (described in more detail in the FAQ's section). If it is difficult to locate the fringes, use the Red Light mode to focus, initially, because fringes are visible in more of the Live Image view. Once the fringes are located, switch back to white light.

8. **Adjust the optics** to make sure that the optical path is perpendicular to the "ideal" end face of the connector.
   - ➢ Detailed pictures and procedures for optics adjustment are located in the FAQ's section of this manual.
   - For *Two Pass*, the mirror screws are adjusted in order for the fringe patterns to be similar in both the front and back orientations of the first connector being analyzed. Do not adjust the mirror after the first connector.
   - For *One Pass W/ "Use Angle Correction"*, the mirror screws should NOT be adjusted during the measurement process. The mirror adjustment is done during an End Face Calibration, which is done prior to this measurement method.
   - For *One Pass W/OUT "Use Angle Correction"*, the mirror screws are adjusted to expand the fringe pattern so that it seems to bubble out from the center to the outer edges of the connector or vice versa during scanning.

9. **Measure the connector –** Press or click on F12 Measure to begin measurement process. Follow screen commands to completion. Results are displayed on a 2D color contour map with surface profiles displayed on the left and bottom of the map. A 3D representation can also be displayed. Measurements of endface geometry are displayed in the lower left hand window.

   NOTE: If it is difficult to center the fibers into the templates, the live image can be enlarged by double clicking on the live image. Scans can be taken with the live image enlarged. Also, the system automatically shifts the stage during measurement. The number of shifts is dependent upon the set-up parameters selected. Do not touch the connector until all segments have been measured and the stage has returned to the starting position.

At the completion of a scan, a beep is sounded to indicate the completion of frame capturing from the camera. Once the beep has sounded, the connector under test can be removed from the mount and a new connector can be inserted in preparation for the next scan. Results will be displayed when data analysis is complete.

CHAPTER 2 - SYSTEM PREPARATION

2.1 Package Inspection

When your system arrives, check the shipping cartons for wrinkled or damaged corners, holes through the cardboard or other signs of rough handling or abuse. If you find any signs of damage, insist that the delivery service make a note describing the damage on the delivery receipt.

If your NC/AC 3005 system arrives in very cold weather, allow the boxes to warm to room temperature before opening them. Exposing a cold unit to a warm room causes condensation that could damage the system. If condensation forms, wait for the unit to dry completely before setting it up and connecting it to an electrical outlet. I

2.2 Unpacking the System

Your system is shipped in three separate boxes (four if the optional B&W monitor is ordered): Microscope Box, Monitor Box, and the Computer Box. Carefully open the three boxes, making sure not to puncture too deeply into the box if using a box cutter. Remove the items in the box **very carefully**. The table below lists the items that should be included in each box. Check off if received. If any equipment is missing or damaged, please contact Norland Products immediately.

NOTE: Norland Products strongly recommends that the NC/AC-3005, original, shipping containers be saved for future transportation needs. These containers may be purchased from Norland Products as P/N A-800100, Microscope Shipping Kit.

Computer Box		Monitor Box		Microscope Box		B&W Monitor Box (optional)	
Keyboard		Monitor Stand		ACCESSORY BOX		B&W monitor	
Computer Manuals		Monitor Manuals		Tilt Stage		BNC Cable	
ACCIS Software CD		Monitor		Micrometer		Power Cord	
NiDAQ CD		Power Cord		20 watt bulb			
Office 2000 Package				Safety Shield Assy			
2 ACCIS Manuals				Magnification Calib.			
Mouse Pad				Allen Keys (8 pc set)			
Mouse				5mm Cable Support			
Power Cord				Mounts Ordered			
Computer				Warranty Card			
				MT 12 fiber connector			
				Report Scan of MT			
				Service&Training Policy			
				CABLE BOX			
				AC Adapter			
				Power Cord			
				Controller Cable			
				BNC Cable			
				3005 Interferometer			
				Dust Cover			

2.3 Assembling The System

Your Norland Interferometer System (NC/AC 3005 w/ ACCIS software) is fully ready to operate. No programming or extensive application software experience is necessary. All functions are self-contained and immediate. Some assembly, however, is necessary. The following section will help you get your system up and running. After all items have been carefully unpacked, obtain the following tools that are needed to set up your system:

An uncluttered sturdy table located near a grounded power outlet.

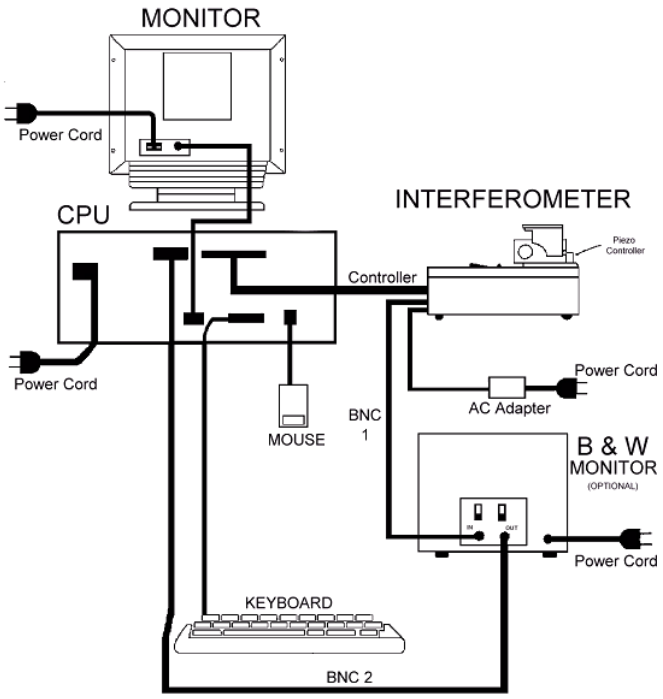
-A power filter/surge protector (optional).

A small slot-type screwdriver.

The picture below labels the step numbers accordingly.

1. Obtain the box labeled Cables from the Microscope Box.
2. Plug the BNC cable (BNC #1) into the back of the interferometer.
   - If a B&W monitor is ordered:
     A. Attach the other end of the BNC cable (BNC #1) into the *Video In* port on the back of the monitor.
     B. Attach the BNC cable (BNC #2) sent with the B&W monitor into the Video Out port on the back of the monitor.
3. Attach the other end of the BNC #1 cable (if B&W monitor ordered, then BNC #2) to the connection at the back of the CPU.
4. Plug the 25-pin Controller Cable into the back of the interferometer as shown by the picture.
5. Attach the 68-pin end of the Controller Cable into the back of the CPU.
6. Attach the monitor to the CPU by inserting the 15 pin D-shell connector to the back of the CPU.
7. Attach the keyboard to the CPU.
8. Attach the mouse to the CPU.
9. Plug the AC adapter into the back of the interferometer.
10. Attach the Power Cords to the AC adapter, CPU, monitor, and B&W Monitor (if ordered).
11. Plug the three (four if B&W monitor is ordered) power cords into a power source.
12. Attach the Tilt Stage and Micrometer to the interferometer. Procedures on next page.

NOTE: Because of constantly improving equipment, some models may vary in the location of serial ports.



2.4 Tilt Stage & Micrometer Installation

The tilt stage is designed to hold mounts for various fiber optic connectors and has the capability of tilting the connectors to angles up to 13° in increments of 0.01° by using the variable tilt micrometer. Each full turn of the micrometer dial represents a 0.50° change.

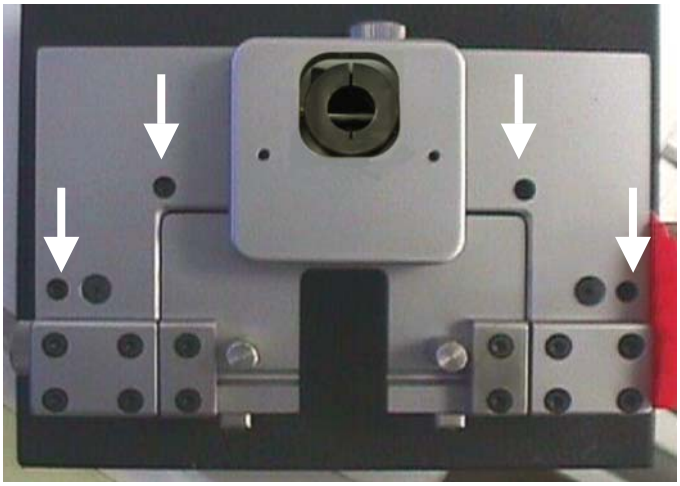
For the greatest accuracy and repeatability when changing the angle of the tilt stage, final adjustments should always be done by turning the micrometer in a clockwise direction. If you approach the final setting from a counterclockwise direction, go past it and return to it from the clockwise direction.

In order to maintain the precision and accuracy of the Norland Interferometer, the tilt stage and the variable tilt micrometer are shipped unassembled from the microscope unit. The engineering staff at Norland Products Inc. has designed these precision components for quick and easy assembly by you, our customer.

Follow the simple, step by step instructions to complete the assembly of the interferometer.

Step 1

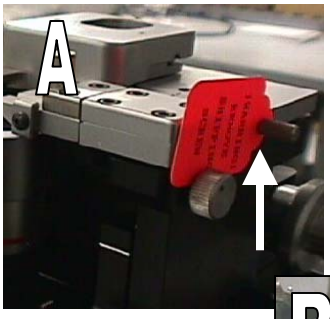
- Insert the four cap head screws into the holes marked by the arrows in the picture.
- Place the tilt stage on top of the microscope by lining up the screws with the four holes on top of the microscope unit.
- Tighten the screws with a 3/32 Allen Key.

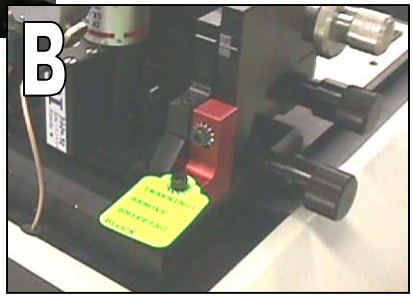


Note: Split Yoke Collar shown.

Step 2

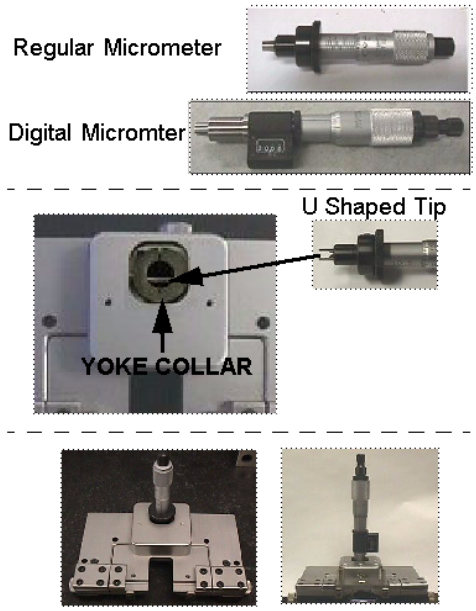
- Remove the shipping screw and the warning label on the right side of the tilt stage. (Picture A)
- Remove the two screws, the shipping block, and the warning label from the right side of the superstructure. (Picture B)





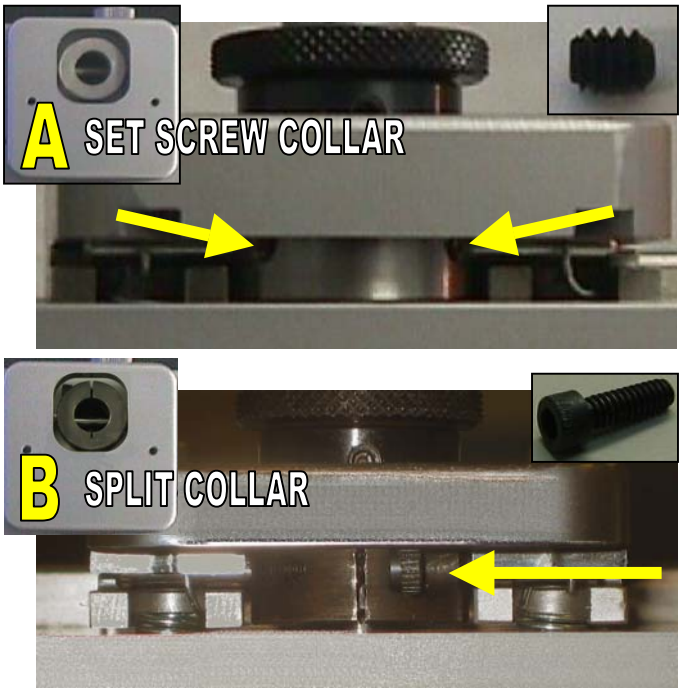
Step 3

- Acquire the (Regular or Digital) micrometer from the Accessory Box.
- Make sure that the circular yoke collar is centered and level. Adjust the position if needed.
    - Insert the micrometer into position by seating the “U” shaped tip (on the bottom of the micrometer) onto the dowel pin in the hole marked by the arrow so that the numbers are facing the front of the microscope.



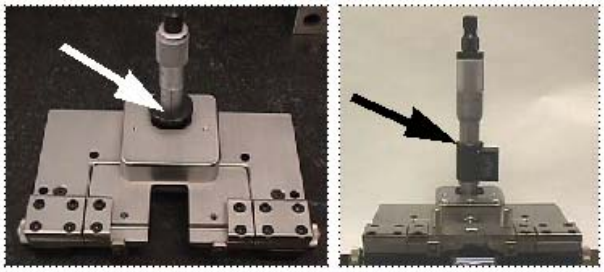
Step 4

- Push down on the micrometer and attach it to the top plate as follows:
    - For a Set Screw Collar (picture A):
        - Insert the two set screws provided, into the two threaded holes in the collar on the back of the tilt stage as shown by the arrows using a 1/16 Allen Key provided. Tighten screws.
    - For a Split Collar (picture B):
        - Insert the cap head screw provided, if not already done so, into the hole indicated by the arrow on the back of the tilt stage using a 3/32 Allen Key provided. Tighten screws.
- The micrometer is installed correctly when the part of the plate where the mount is attached is lower than or even with the main top plate. If it is higher, the micrometer was installed incorrectly. Correct this by loosening the screws, making sure the micrometer is seated correctly over the dowel pin and then tightening the screws.



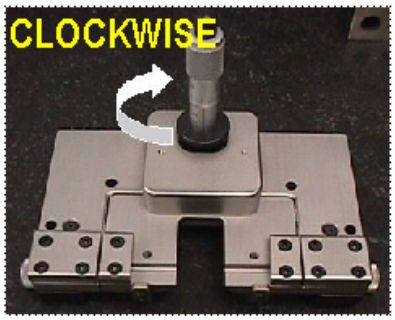
Step 5

- Unlock the micrometer by turning the black collar (indicated by the arrow in the picture) clockwise.



Step 6

- Turn the micrometer clockwise to 0.0°.
- Lock collar into position by turning the black collar clockwise.
  - When changing the angle of the stage, always remember unlock the micrometer by turning the black lock collar counterclockwise. When the correct angle is reached, lock the micrometer into position.
- NOTE: If micrometer has to be re-installed, turn the micrometer head counterclockwise by the amount listed on the micrometer (picture A) from the 0.0° position. Repeat installation procedure.



0.0° Position§

NOTE: Regular micrometer shown.§

SAFETY COVER

It is important to protect the piezo-electric device on the interferometer with the safety cover included in the Accessory Box. To install, place the safety cover over the piezo device, being careful not to harm the wire. Attach the safety cover to the interferometer with the two screws also included in the Accessory Box. Refer to Figure 1.

NOTE: The shipping block has to be removed BEFORE attaching the safety cover.

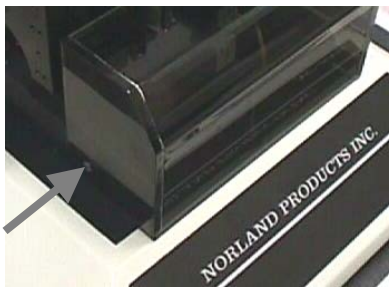


FIGURE 1

CABLE SUPPORT - Single Fiber

The cable support stabilizes the connector when placed into the mount. Should be used when measuring connectors with stiff cables. To attach, remove one of the screws indicated in Figure 2 with a 1/16" allen key and screw on the cable support as shown in Figure 3.

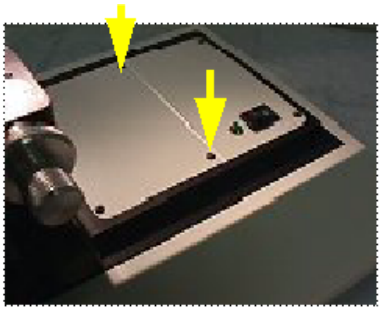


FIGURE 2

FIGURE 3

CABLE SUPPORT - Multi Fiber

The cable support stabilizes the connector when placed into the mount. Should be used when measuring connectors with stiff cables. To attach, remove the two screws indicated in Figure 4. Place the cable support on the stage as shown in Figure 5, and attach using the two screws included.

FIGURE 4

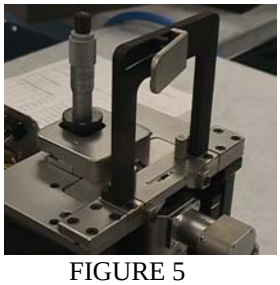


FIGURE 5

CHAPTER 3 - ACCIS PROGRAM

The following section of the User Manual will help you familiarize yourself with the ACCIS Program installed in the computer. It provides simple explanations and graphics of all the features the ACCIS program offers. This section consists of the following:

- Starting the ACCIS Program
- Menu Bar features
- Tool Bar Features
- Info Bar Features

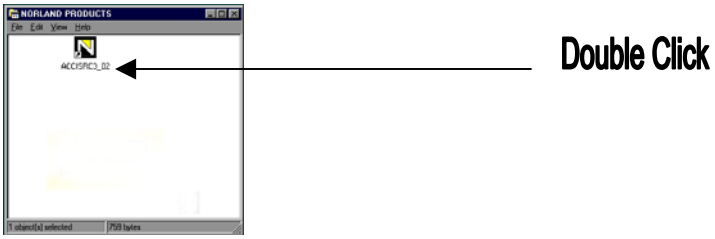
3.1 Starting ACCIS Program

1.Turn on the computer, monitor and interferometer. Allow the interferometer to warm up for at least 2-3 minutes.

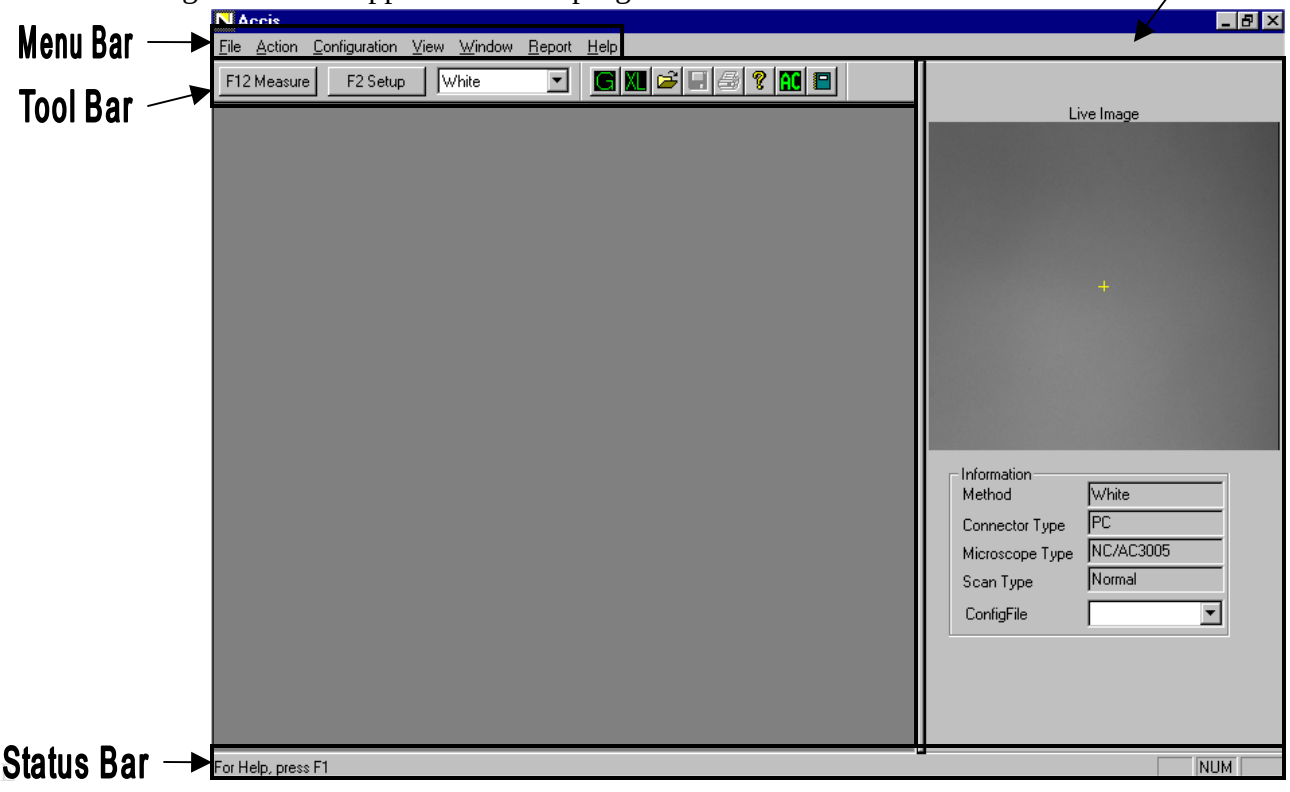
2.Press Ctrl+Alt+Del when prompted.

3.A log on prompt will appear with the user name Administrator. Press OK to log on.

4.Windows will display the NORLAND PRODUCTS group with the ACCIS Icon. Double click the *ACCIS v3.02* icon to activate the program.

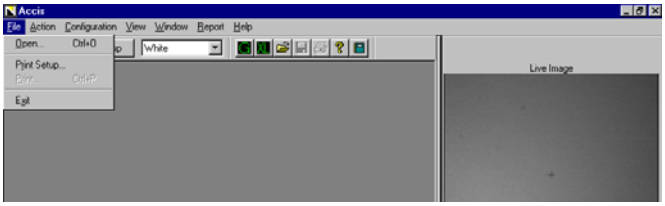


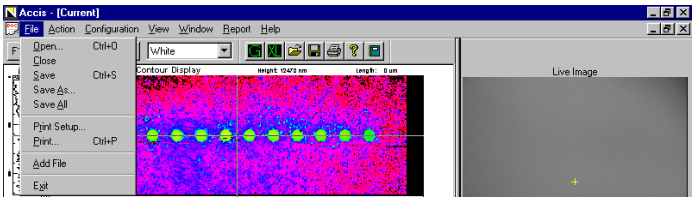
5.The following screen will appear when the program is activated:



3.2 Menu Bar Functions

FILE





NOTE: The ***File*** pull down menu provides more choices after measurements have been taken.

OPEN - Opens saved files of the following file types:

- *.xls - Microsoft Excel Files which contain quantitative data in spreadsheet form. Opens in Microsoft Excel Program.
- *.nld - Norland Files which contain scan results, graphic images, and set-up parameters. Opens in ACCIS program.

CLOSE - Closes the current connector measurements (Surface Contour Files). If selected, a prompt will ask the operator whether or not to save scans. Choose *Yes* to save. Choose *No* no to save. Choose *Cancel* to return to the program.

SAVE, **SAVE AS**…, **SAVE ALL -** Saves the information/data of the connector measurement under the following file types:

- *.xls - Microsoft Excel Files which contain quantitative data in spreadsheet form.
- *.nld - Norland Files which contain data, graphic images, and set-up parameters.
- *.csv – Comma-Separated Values which contains the quantitative data, scan results, contour data, and set-up parameters. *.csv files can be exported to an external graphical analysis utility.

If save is selected, a prompt will ask the operator to choose where to save the file, under what name to save the file, and what file type to save it as. Choose *OK* to save the information. Choose *Cancel* to return to the program.

SAVE - will save the connector measurement under the Connector ID entered in the measurement process.

SAVE AS - will save the connector measurement under a name different from Connector ID entered in the measurement process.

SAVE ALL - will save all current files under the Connector ID entered in the measurement process.

PRINT SET-UP- Set-up of the following printer parameters (modify as needed):

Printer

Page size, source, and orientation

PRINT… - Prints Surface Contour Displays and measurement data. The measurement data is included at the bottom. Does not print reports.

NOTE: Only prints *.nld file types

ADD FILE - will add scan data to a selected Excel file from any measurement currently being viewed.

EXIT - If selected, a prompt will ask the operator whether or not to exit the program. Select *Yes* to exit or *No* to return to the program. If you have unsaved scan results displayed on the screen when you exit, you will be asked whether to save those results. Select *Yes* to save scan results or *No/Cancel* not to. If there are many unsaved scans and it is not desired to save any of them, choose menu choice *Window* → *Close All* before selecting *File* → *Exit.*

Always exit Windows before turning the computer off.

ACTION

MEASURE - Activates scanning and measurement of the connector mounted in the interferometer. It begins by displaying a window showing scan progress. The operator can input a Connector ID at any time before clicking "OK" or pressing Enter. During the scan, a beep is sounded to indicate completion of frame capturing from the camera for the scan segment. As many as six scan segments are used to make a complete composite scan. The number of segments depends on the Ribbon Style selected in the Set Up Menu. The connector is automatically shifted between each scan segment. The operator is prompted to refocus as needed before the start of each segment (unless the 'Auto Focus' option has been selected in the SETUP menu). Do not touch the connector until all segments have been measured and the stage has returned to the starting position.

MAGNIFICATION CALIBRATION - Stores the Magnification Calibration Factors into the system.

- Only active when Magnification Calibration is selected in the Set-Up→Scan Type

ILLUMINATION CALIBRATION – This menu choice, available to all levels of ACCIS users, provides capability for automatic as well as manual adjustment of the default Brightness and Contrast settings and an intensity profile display that is constantly updated and uses the middle row of live grabs. Pressing (AutoAdjust), Brightness and Contrast settings are automatically adjusted, and using the slide bars, Brightness and Contrast settings are manually adjusted causing an immediate change to the Live Image. These changes could be saved by pressing "Save" and used later as default values (Default). At any time before exiting, changes could be canceled by pressing "Cancel". Pressing "Test" will display the intensity profile. Before activating the AutoAdjust function in this dialog, a connector needs to be installed in the interferometer fixture and its ferrule type correctly indicated in the Setup menu's Ferrule Type field.

CONFIGURATION

SET-UP - Controls the parameters for the measuring process and data handling. **NOTE: There are different set-up screens for Red Light and White Light.**

- Refer to CONFIGURING DATA – Set Up Parameters for more detailed information and procedures

MODE - Switches between Red Light and White Light Modes for measurement.

- Red light is used for fast analysis of smooth surfaces
- White light is used for rough surfaces or surfaces containing step heights.

CONNECTOR - Configures the data to exclude certain user defined regions from the final data analysis.

- Refer to CONFIGURING DATA - Connector Configuration for Fiber Masking for more detailed information and procedures.

OPTION - Configures the output settings. (I.e auto save, auto increment, data/configuration paths, etc.)

- Refer to CONFIGURATING DATA – Option Parameters for more detailed information and procedures.

VIEW

VIEW - Controls the visibility of the Toolbar, Status Bar, and Info Bar. A check next to the choices makes it visible on the screen. Selecting **FULL SCREEN (F10)** will hide the Menu Bar and Status bar. The Toolbar buttons are moved into the Info Bar.

- This feature should be used in Production situations were the menu bar needs to be hidden from the Operator so that certain parameters in the program cannot be change. i.e. AutoCal and Option Parameters.

WINDOW

LIVE IMAGE - Controls the Live Image size. Toggles between small screen and full screen.

SURFACE CONTOUR - Controls the Surface Contour Display Size. Toggles between small screen and full screen.

- Refer to UNDERSTANDING And INTERPRETING DATA for more detailed information and procedures.

CASCADE - Shows multiple scans and data files on the screen.

CLOSE ALL - Closes all measurement results windows without saving data.

Selecting a connector ID will activate the Measurement Results Windows as the current display to be viewed.

REPORT

GENERATE – Prints the report containing the data saved into the Microsoft Access database when "Auto Save to Database" selected in Option dialog . A form will be displayed allowing the selection of a previously created configuration layout to use in the PRINT REPORT field. The user can also select the printer.

CONFIGURE - Configures reports for different clients, the user should select this option. Users can change the company information as well as insert the logo of company. Select the type and order of test parameters to be shown on the report and click on View to view the chosen configuration. Click on Save to save the format to any name, with chosen name appearing in the Layout list box. The Layout list box shows all the previously saved layouts, allowing user to make the selection. Click on Exit to close the configure form.

HELP

HELP TOPICS - Accesses an online version of the User Manual for the ACCIS program and microscope unit.

ABOUT ACCIS - Check the copyright or version of the ACCIS version.

3.3 Tool Bar Features

The ACCIS Toolbar offers a quick way to access the most commonly used functions in the program.

1. **MEASURE** (can also be accessed by the **F12** Function Key**)**
   - Activates scanning and measurement of the connector mounted in the interferometer. It begins by displaying a window showing scan progress. The operator can input a Connector Identification at any time before clicking "OK", or pressing Enter. During the scan, a beep is sounded to indicate completion of frame capturing from the camera for the present scan segment. As many as six scan segments are used to make a complete composite scan. The number of segments depends on the Ribbon Style selected by the operator in the Set Up Menu. The connector is automatically shifted between each scan segment. The operator is prompted to refocus as needed before the start of each segment (unless the 'Auto Focus' option has been selected in the SETUP menu). Do not touch the connector before all have been measured and the stage has returned to the starting position.
     - Refer to MEASURING a CONNECTOR for more detailed information and procedures

2. **SET-UP** (can also be accessed by **F2** Function Key)
   - Controls the parameters for the measuring process and data handling.
     - Different for Red Light and White Light

   Refer to CONFIGURING DATA – Set Up Parameters for more detailed information and procedures

3. **MODE** (can also be accessed "r"/"w"/"↑"/"↓" when active)
   - Switches between Red Light and White Light Modes
     - Red light is used for fast analysis of smooth surfaces
     - White light is used for rough surfaces or surfaces containing step heights.

4. **GROUP NAME**
   - Names the Excel Spreadsheet where connector measurement data will be saved. Group names can be changed to any 50 character alphanumeric name desired by the user. Use *Default* as the default setting. NOTE: A scan must be taken before a spreadsheet is created.
   - Locates an existing spreadsheet in the Data Path (Configuration/Option/System/Data Path). Once located, click the *XL* button on the toolbar to open desired spreadsheet named in the Group name Dialog Box

5. **CURRENT SPREADSHEET**
   - Clicking on *XL* button will open an existing spreadsheet with a name corresponding to the name entered in Group Name. If a spreadsheet with a name specified in the Group Name box does not exist in the Data Path an error message would be displayed, make sure the path is correct. NOTE: A spreadsheet is only created once a measurement has been taken.

6. **OPEN** (can also be accessed by "**CTRL+O**")
   - Opens saved files of the following file types:
     - *.xls - Microsoft Excel Files which contain quantitative data in spreadsheet form. Opens in Microsoft Excel Program.
     - *.nld - Norland Files which contain scan results, graphic images, and set-up parameters. Opens in ACCIS program.

7. **SAVE (**can also be accessed by **CTRL+S**)
   - Saves the information/data of the connector measurement under the following file types under the CONNECTOR ID entered in the measurement process:

     *.xls - Microsoft Excel Files which contain quantitative data in spreadsheet form.

     *.nld - Norland Files which contain data, graphic images, and set-up parameters.

     *.csv – Comma-Separated Values which contains the quantitative data, scan results, contour data, and set-up parameters. *.csv files can be exported to an external graphical analysis utility.

8. **PRINT** (can also be accessed by **CTRL+P**)
   - PRINT will print Surface Contour Files

9. **HELP TOPICS** (can also be accessed by **F1**)
   - An index of all the topics related to the ACCIS program and microscope unit.

10. **ANGLE CALIBRATION**
    - **NOTE: This feature should ONLY be used with the NORLAND ADVANTAGE SYSTEM or an NC/AC 3005 system w/ Fixed Mirrors. For systems with adjustable mirrprs, conduct an End face Angle Calibration as explained in the Calibration Section of this manual to level the stage.**
    - Activates the Angle Calibration (AC) feature, which is similar to the OC feature for single fiber stage leveling. AC provides assistance in leveling the stage in order for the connector to be held exactly perpendicular to the interferometric objective lens, which assures measurements of the endface geometry. Correction factors are also calculated for fine tune leveling of the stage. Any relatively flat multi fiber connector can be used during the AC procedure. The "Clear factors" button in the AC dialog box sets the correction factors to zero (not required during the normal use of AC). The AC feature also includes a "Use Known Angle" selection, if the angle of the connectors are known.

11. **REPORT** prints a report of measurements made. Refer to Report Generation Section.

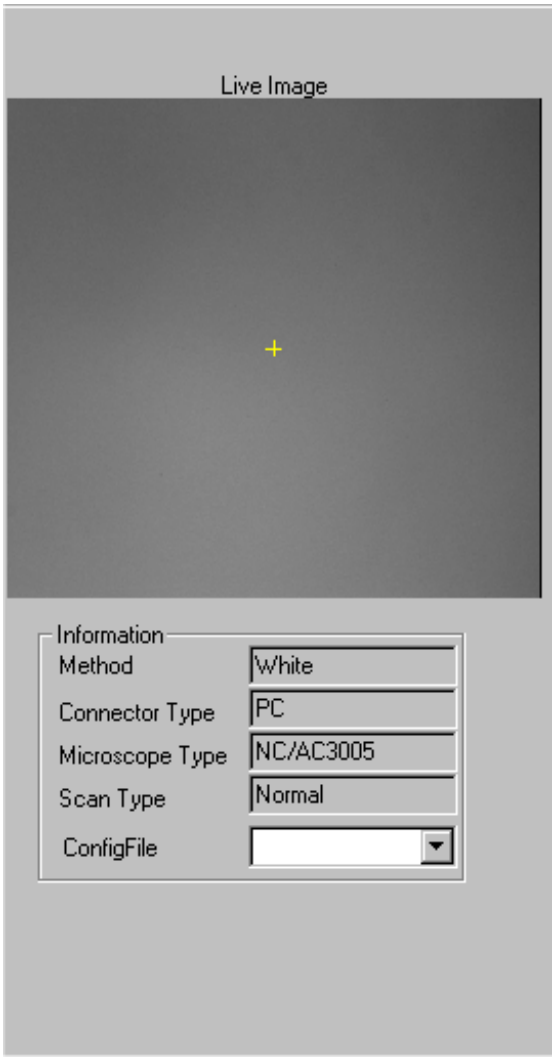
3.4 Info Bar Features

LIVE IMAGE - Displays the live image of the connector being measured. It helps in the location of the fiber and guide holes and shows the fringe pattern (when correctly focused) that represents specific heights across the surface.

METHOD – Displays the measurement method used during the scanning process. (Red light or white light)

RED – used for fast analysis of smooth surfaces.

WHITE – used for rough surfaces or surfaces containing step heights.



CONNECTOR TYPE - Displays the connector type selected in the Set-Up menu for the connector being measured.

PC – Physical Contact (zero degree polish)

APC – Angled Physical Contact (angled polish).

MICROSCOPE TYPE - Specifies the choice of the interferometric system used with the ACCIS software.

NC/AC 3005 - Multi fiber system.

NC/AC 3000 - Single fiber system (Listed, but cannot be selected w/ this software.)

Advantage - Combination system for single and multi fiber measurements

SCAN TYPE: Displays the type of scan that will be used to measure the connector.

Normal - Standard measurement mode for multifiber PC/APC connectors. For use with both edge alignment and pin alignment mounts

Magnification Calibration - Sets the required magnification calibration. For use only with Edge Alignment mount or NIST Traceable Calibration Reticle.

End face Angle Calibration - Determines the X and Y Angle Correction Factors for the Pin Alignment mount being used. NOTE: This feature should only be used for the NC/AC 3005 with adjustable mirrors. For Angle Calibration on the Advantage system or NC/AC 3005 w/ Fixed Mirrors, use the AC feature on the toolbar. Refer to Chapter 5 for more details and procedures.

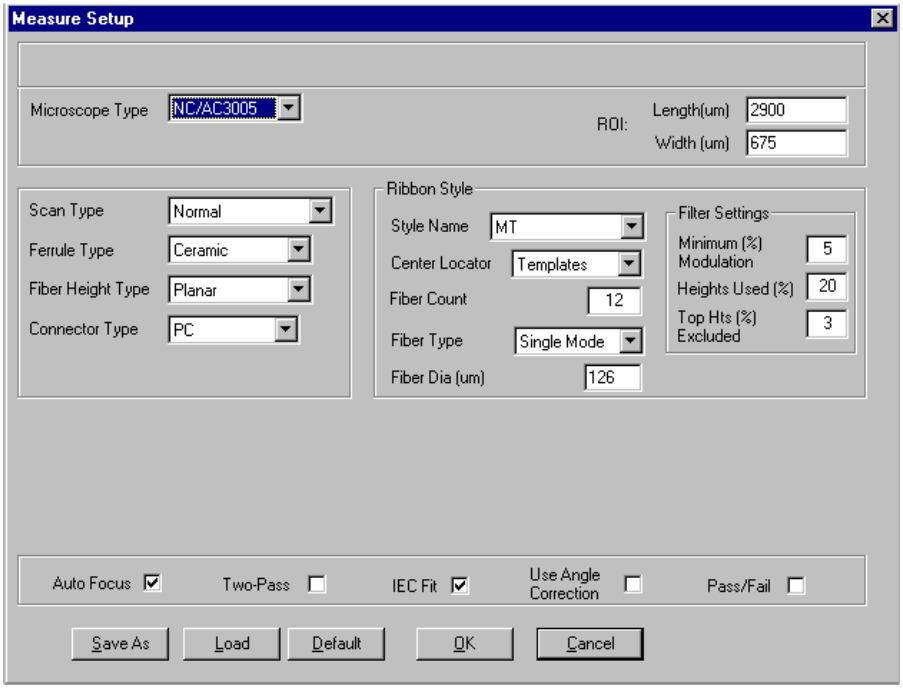
CONFIGURATION FILE – Displays a drop down menu of the configurations files (Set-Up menus) saved by ACCIS Administrators. Can be used by any security level.

CHAPTER 4 - CONFIGURING DATA

Before running measurements, it is necessary to verify/modify a variety of parameters that control the way the system acquires and uses data during and after the measuring process. In order to control the data during measurement scans, it is important to modify the Set-Up parameters according to the connector being measured as well as ACCIS Administrator preferences. In order to control the data after measurements have been taken, it is important to modify the Option Parameters according to how the ACCIS Administrator wants to store and handle the data.

4.1 Set-up Parameters

Independent SETUP screens exist for the Red Light and White Light modes. Parameters in the Set-Up screen are similar for both modes. The parameters can be modified/changed by using the mouse to highlight the desired field then clicking the mouse on the appropriate choice in the field.



MICROSCOPE TYPE - Specifies the choice of the interferometric system being used with the ACCIS software. Choose one of the following:

NC/AC 3005 - Multi fiber system.

NC/AC 3000 - Single fiber system (Listed, but cannot be selected w/ this software.)

Advantage - Combination system for single and multi fiber measurements

REGION OF INTEREST (ROI): The area on the surface of the ferrule in which data is collected. Enter the correct length and width dimensions to assure accurate measurements.

Length-Dimension of area along X-axis on the surface of the ferrule to be used for measurements.

Width- Dimension of area along Y-axis on the surface of the ferrule to be used for measurements.

SCAN TYPE: Determines the type of scan that will be used to measure the connector. Choose from the following options:

Normal - Standard measurement mode. Refer to MEASURING A CONNECTOR for more detailed explanation and procedures.

Magnification Calibration - Sets the required magnification calibration. Refer to CALIBRATION TOOLS for more detailed explanation and procedures.

End face Angle Calibration - Determines the X and Y Angle Correction Factors for the Pin Alignment mount being used. Refer to CALIBRATION TOOLS for more detailed explanation and procedures.

FERRULE TYPE: Choose one of the following depending on the connector ferrule being measured.

Ceramic – Connector with a ceramic end face.

Metal – Connector with a metal or high reflectivity end face.

FIBER HEIGHT TYPE: Specifies which type of fiber height measurements will be displayed and printed. Choose one of the following:

Planar

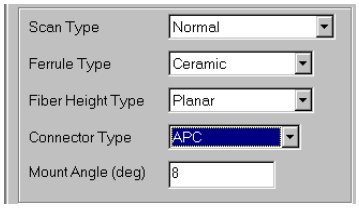
Spherical

NOTE: Both planar and spherical fiber heights will always be measured and, if requested in Configure/Options/Spreadsheet Settings, stored to the active spreadsheet upon successful completion of the scan. Refer to OPTION PARAMETERS in this section for more information on spreadsheet settings. Refer to the UNDERSTANDING and INTERPRETING DATA section for a more detailed explanation of Planar and Spherical Fiber Heights.

CONNECTOR TYPE: Choose the connector type being measured. Choose one of the following:

PC – Physical Contact (zero degree polish)

APC – Angled Physical Contact (angled polish). MOUNT ANGLE field appears when selected. Enter the polish angle of the connector being measured.



STYLE NAME: Choose the type of Multiple Fiber connector to be measured. Others will be added as software is developed to handle them. Choose one of the following:

MT - assumes a 250 micron center to center fiber spacing.

MiniMT - center to center fiber spacing is dependent on the value entered in the "Fiber Count" field. For a fiber count of 2, the ACCIS program assumes a 750 micron fiber spacing. The software assumes a spacing of 375 microns for a fiber count of 3. For a fiber count of 4 and more, a 250 micron spacing is used.

Si V Groove

General Surface - General Surface choice will activate a scan mode which performs a single scan, mapping only what is visible in the Live View when the scan is started. Fiber spacing follows same as MiniMt.

CENTER LOCATOR: Determines the location of the center of the connector so that scans can be accurately measured. Select Templates when Guide Holes are not visible on Live Image display, for example, due to use of fixture with integral guide pins (i.e.; Pin Alignment mounts). Choose from the

following:

- *Guide Holes* – measures entire end face, including guide holes (use w/ Edge Alignment Mnt)
- *Templates* – provides a template at the beginning of a scan to align fibers (use w/ True Angle Pin Alignment Mnt)

FIBER COUNT: The number of fibers in the connector that will be measured. Enter the correct fiber count to assure accurate measurements. Allows values of 1-24. For fiber spacing information, review "Style Names"

FIBER TYPE: Choose the type of fiber to be measured. Choose from the following selections:

Single Mode

Multi Mode – When selected, the amount of the fiber center surface used to calculate its fiber height is increased to a 100 micron diameter region (instead of 50 micron for Single Mode fiber) and a set of Core Dip measurements is added to the data output.

FIBER DIAMETER - Specifies the fiber diameter in microns (within ± 2% accuracy) of the connector being tested -- 126 microns is the default setting (This number actually represents the average diameter between the fiber O.D. and ferrule I.D). Enter the fiber diameter of the connector being measured to assure accurate measurements.

MINIMUM % MODULATION: Specifies the minimum amount of intensity change (i.e.; modulation) required at a pixel during a scan. For example, if this field is set to 5% and a pixel has less than 5% of an intensity change, the pixel will not be used during measurements. If a pixel has 5% or more of an intensity change, the pixel will be used. The factory default setting of 5% has been chosen after extensive testing.

NOTE: Care should be taken when changing from this value. When measuring extremely rough surfaces, the minimum modulation may be increased to 8% or 9% for greater repeatability.

PERCENTAGE (%) OF HEIGHTS USED: Specifies the percentage of highest points in the Region of Interest used to define the best fit plane used for data analysis. That best-fitting plane then determines the resulting Planar Fiber Heights, X End face Angle, and Y End face Angle. This field only becomes active if the Planar Fit option has been turned On.

NOTE: Percentage of Heights Used is only active if IEC fit is selected. IEC specifies 20% to be used.

PERCENTAGE (%) OF TOP HEIGHTS EXCLUDED: Specifies the percentage of the highest points to be excluded in the Region of Interest.

*NOTE: Percentage of Top Heights Excluded is only active if **IEC fit** is selected. IED specifies 3% to be used.*

AUTO FOCUS: When checked, an auto-focusing process will occur prior to each scan segment being mapped to determine the region in which fringes appear. Scans will only be done on the region determined by auto-focus. Occasionally auto-focus may fail, and the user will be prompted to manually refocus. If not checked, the program will scan the entire range and will stop between scan segments to ask the operator to manually refocus if no fringes are visible prior to the next scan segment.

TWO-PASS: When not checked, the measurement mode will go through a One Pass Measurement. When checked, this mode automatically guides the user in scanning a connector in two consecutive 180° rotations of the connector. Following the sequence of two full scans, each resulting End face Angle(X & Y) measurement will be computed as an average of the first and second scan results for that Surface Angle. Assuming the connector is being held in a Pin Alignment mount, this computed End face Angle will be the true angle of the surface with respect to the Guide Hole Axis. All other measurements relate to the second scan (for example, Fiber Height #1 is for the leftmost fiber on the screen when the connector is in the final scan position). Refer to CALIBRATION TOOLS for more detailed explanation and procedures for End face Angle Calibration. Refer to MEASURING A CONNECTOR for procedures of One Pass and Two Pass Measurements.

NOTE: *The two pass method should not be used with Edge Alignment mounts. Can be activated in Normal and End face Angle Calibration Scan Types only using a mount with pins. End face Angle Calibration defaults to Two-Pass to determine the angle correction factors for the mount being used When angle correction factors are determined, "Use Angle Correction" can be selected during normal scanning for one pass data analysis. If Fiber Masking is being done to the connector, the masked region should be symmetrical in both orientations of the connector.*

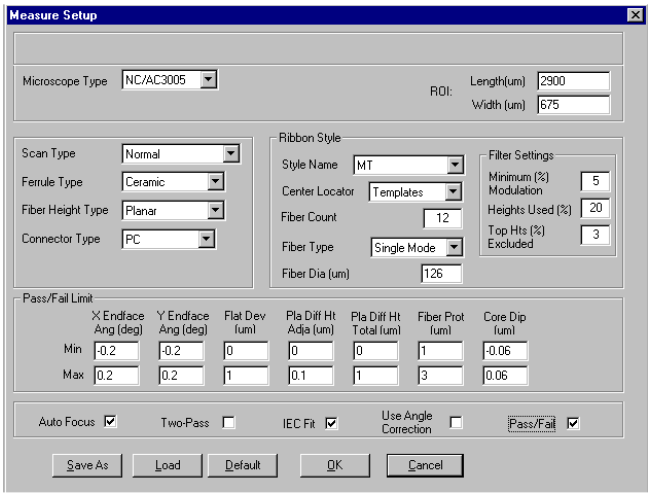
IEC FIT: When this box is checked, the ACCIS software is programmed to follow the IEC test procedure for Multi fiber connectors. Filter settings are enabled with default settings for the present IEC standards. If this option is not checked, measurements will be derived from a single bi parabolic fit to data points selected only through settings of the Region of Interest dimensions and the Minimum Modulation percentage. This option also will enable filter-settings other than the IEC recommendations.

NOTE: *Heights Used and Heights Excluded cannot be selected or modified when IEC is not checked.*

USE ANGLE CORRECTION: When checked, the program will conduct a One Pass measurement using the correction factors determined from a End face Angle Calibration.
Refer to CALIBRATION TOOLS for more detailed explanation and procedures for End face Angle Calibration. Refer to MEASURING A CONNECTOR for procedures of One Pass Measurements.

PASS/FAIL: When this box is checked, a set of fields appear that allow the Pass/Fail criteria to be entered into the program. At the completion of a successful scan, the quantitative results are compared against these limits and Pass/Fail notifications are added to the data output.

NOTE: *The user must be logged on as an ACCIS Administrator to be able to modify the Pass/Fail parameters. The default Pass/Fail values are subject to change as the Suggested Telcordia/IEC FIT Pass/Fail parameters change.*



SAVE AS: If multiple Set-Up screens are used in production, an ACCIS administrator can save the Set-Up parameters into separate *.cfg files. The saved parameters can be loaded when needed by operator level users. (Configuration Path for where the data will be saved can be changed in *Configuration/Option/System Tab/Configuration Data*).

LOAD: An operator level user or ACCIS administrator can load previously saved Set-Up parameters. Operator level users cannot change any Set-Up parameters.

DEFAULT: Returns all values to the default settings.

OK: Exits the Setup Screen and returns to the Main Menu. The settings will be saved automatically.

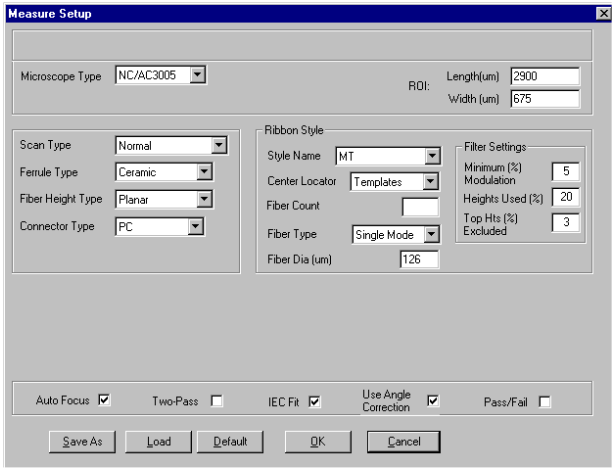
CANCEL:Exits without saving changes.

4.2 Recommended Set-Up Parameters

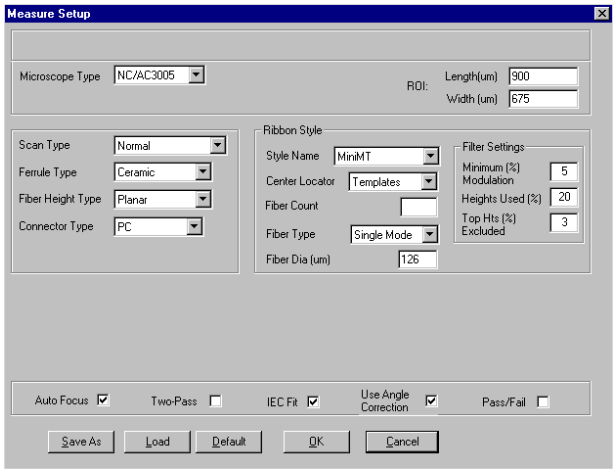
The latest IEC recommended procedure for measuring the angle of multifiber connectors uses the ideal end face perpendicular to the centerlines of the guide holes/pins of the connector as the reference. This is accomplished with the latest Pin Alignment Connector Mounts from Norland Products that use mounts with aperture plates and integral guide pins/holes for holding connectors in the correct alignment.

Below are the recommended Set-Up parameters for MT/MiniMT type connectors based on the present guidelines being considered by the TIA (Telephone Industry Association) and the IEC (International Electrotechnical Committee).

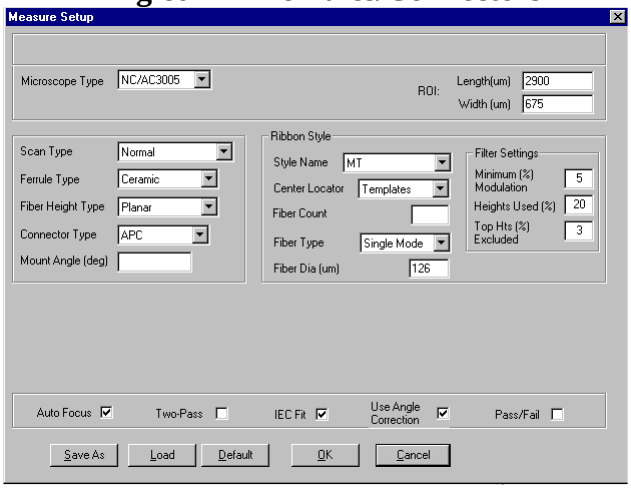
MT Ferrules/Connectors*



MiniMT Ferrules/Connectors*



Angled MT Ferrules/Connectors*



***NOTE:**

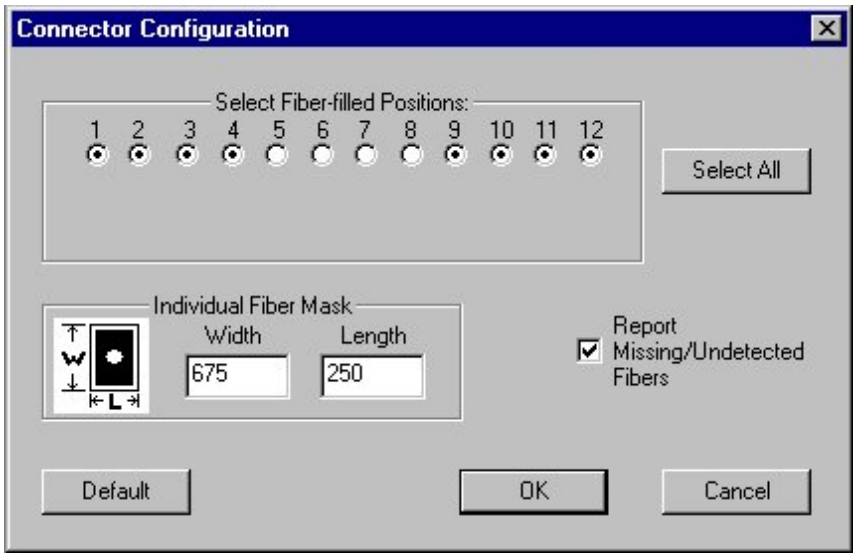
- Pin Alignment mounts - select One Pass w/ “Use Angle Correction”.
- Edge Alignment mounts – select One Pass w/OUT “Use Angle Correction”
- Enter the number of fibers in the connector in “Fiber Count.”
- If measuring extremely rough surfaces, the Minimum Modulation can be increased to 9% in order to achieve greater repeatability.
- Enter the Mount Angle for APC Connectors
- For connectors that have unfilled fiber positions, please review Configuring Data/Connector Configurations for Fiber Masking.

4.3 Connector Configuration for Fiber Masking

Connector Configuration is a feature of the ACCIS software that allows the user to choose individual fiber locations and some surrounding ferrule to be excluded from all surface analysis after the connector surface has been entirely mapped. This versatile feature is helpful when measuring connectors that have different fiber configurations than the standard connectors in the industry. The software assumes that the shape, size, and fiber orientation (i.e. fiber to fiber distance) follows industry standards. An example of this would be a 12-fiber MT design with only fibers 1 through 4 and 9 through 12 present. With present polishing techniques, the ferrule becomes eroded more where fibers are missing from the array than when fibers are present. If this connector is measured as if it were a standard MT, it usually is reported as a production failure for two reasons. First, the fiber height measurements fail at the locations where there are uninstalled fibers (which can be completely empty holes, holes filled with epoxy, or in some versions – no holes at all, just ferrule material). Secondly, measurements such as ferrule curvature, flatness deviation, endface angle, and fiber heights for the existing fibers are all affected, sometimes resulting in failing production limits due to the previously-mentioned additional ferrule erosion where fibers are missing. Since this connector design is meant to be used differently than the standard MT, these reports of failure are misleading and inappropriate.

The Connector Configuration dialog is dependent on the Set-Up Parameters selected. For example, if 8 fibers is selected in "Fiber Count" in the set-up menu, only 8 fiber positions will appear in the Connector Configuration dialog, therefore it is very important to always check the connector configuration dialog after any changes have been made to the mode or set-up menu.

NOTE: Norland Products believes that Fiber Masking is an excellent method for testing certain custom mulitifber connectors. Fiber Masking is not included in the present TIA/IEC fiber optic test procedure.



SELECT FIBER FILLED POSITIONS: Defines the desired exclusion sections of the connector. "Select All" button can be pressed if all fiber positions are filled.

INDIVIDUAL FIBER MASK: Defines the region size of surrounding ferrule that can be selected for exclusion.

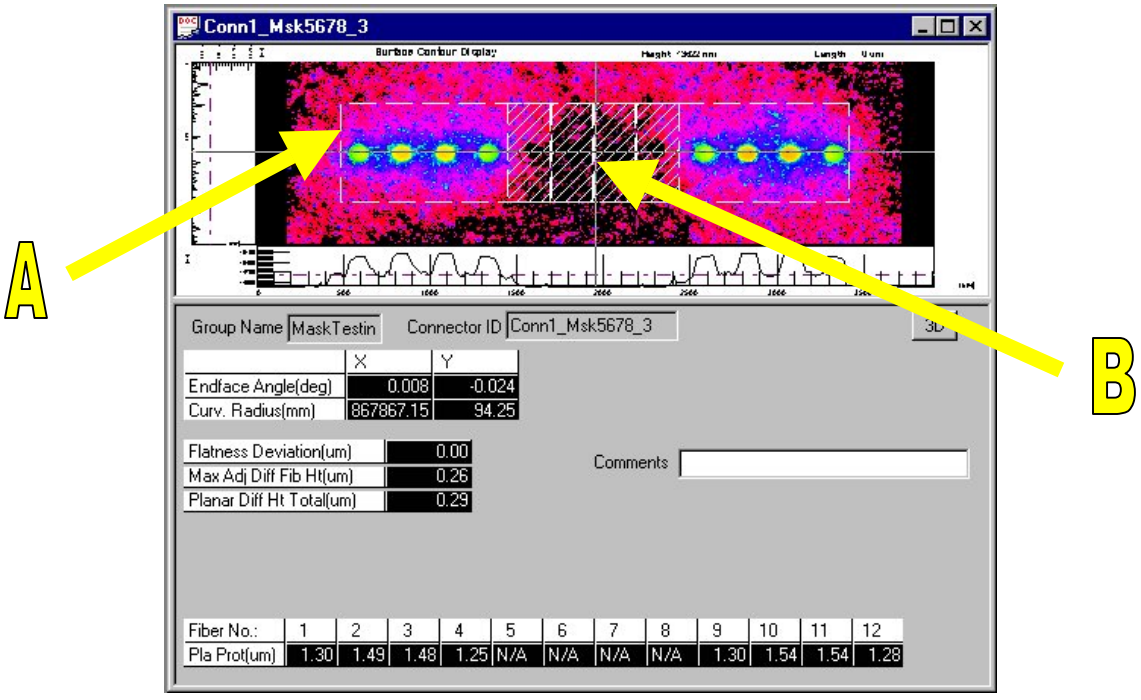
REPORT MISSING/UNDETECTED FIBERS CHECKBOX: If selected, the software will display warning messages to the User when fiber detection and/or fiber height measurement does not succeed for one or more fibers during a scan. However, a situation may arise when a User is aware of a missing fiber but chooses not to mask it. The User will receive a warning message each time this connector is scanned and will have to respond to each message. For this situation, scanning can be simplified and streamlined by deselecting this option.

The figure below illustrates fiber masking on fibers 5-8 of a standard 12 fiber MT connector. With this feature, the Region of Interest is indicated in the Surface Contour Display by the large dashed rectangular region (Arrow A). The fiber masking area is also indicated in the Surface Contour Display by the hatched rectangular region (Arrow B).

After a User defines the desired exclusion sections of the connector and performs a scan, the measurements are calculated only from the remaining unmasked sections inside the Region of Interest (fibers 1-4 and 9-12 in the figure below). For fibers that have been masked, the fiber height (planar or spherical protrusion) will appear in the measurement results as N/A ("not applicable") on screen, in print, and in exported files. Also, the fibers will not be included in related calculations such as Fiber Differential Height or Adjacent Maximum Differential Height.

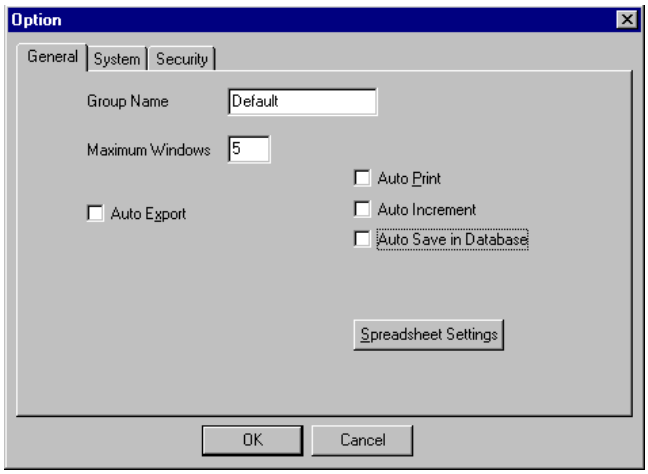
IMPORTANT NOTES:

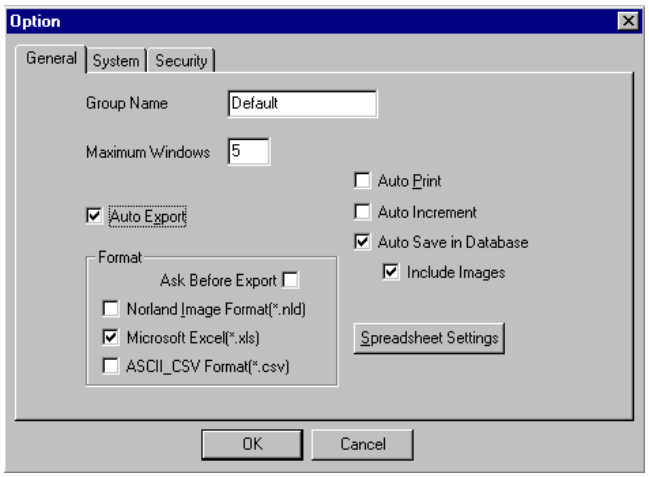
- Fiber masking will not directly affect the 3D display.
- If Pass/Fail is selected in the Set-Up Dialog, masked fibers will not be checked against the Pass/Fail limits.
- If conducting two pass measurements, the fiber masking regions must be symmetrical for both orientations. For one pass measurements, no special actions have to be taken.


A
B
Conn1_Msk5678_3
Group Name MaskTestin
Connector ID Conn1_Msk5678_3
X
Y
Endface Angle(deg) 0.008 -0.024
Curv. Radius(mm) 867867.15 94.25
Flatness Deviation(um) 0.00
Max Adj Diff Fib Ht(um) 0.26
Planar Diff Ht Total(um) 0.29
Comments
Fiber No.: 1 2 3 4 5 6 7 8 9 10 11 12
Pla Prot(um) 1.30 1.49 1.48 1.25 N/A N/A N/A N/A 1.30 1.54 1.54 1.28

4.4 Option Parameters

GENERAL (Configuration/Option/General Tab)





Auto-Export and Auto Save in Database is selected

Group Name: Names the Excel Spreadsheet where connector measurement data will be saved. Group names can be changed to any 50 character alphanumeric name desired by the user. Typing in an existing Group Name will locate an existing spreadsheet and append data to it (if Group Name was used previously to give a name to a spreadsheet). Make sure the correct data path is entered. Use "**Default**" as the default setting. NOTE: Spreadsheet is created after first scan.

Maximum Windows: The value entered here determines the Maximum number of Measurement Results windows that will be shown on the screen (Default setting: 5)

Auto Print: When checked, the operator will be prompted to print a report at the completion of a measurement. Will only print Surface Contour, Surface Display, 3D Mesh, and data information. Does not print Reports (Refer to Print Chapter of this manual). The printer attached to the parallel printer port on the computer must be compatible with **Windows NT**.

AutoExport: When checked, the operator will be prompted to save the results at the completion of a measurement. If the "Ask Before Exporting" checkbox has been selected, the operator will be prompted to save the results at the completion of a measurement (if not checked, saving will proceed without prompting). Choose one of the file types for data storage:

- *.xls - Microsoft Excel Files which contain quantitative data in spreadsheet form
- *.nld - Norland Files which contain data, graphic images, and set-up parameters.
- *.csv – Comma-Separated Values which contains the quantitative data, scan results, contour data, and set-up parameters. *.csv files can be exported to an external graphical analysis utility.

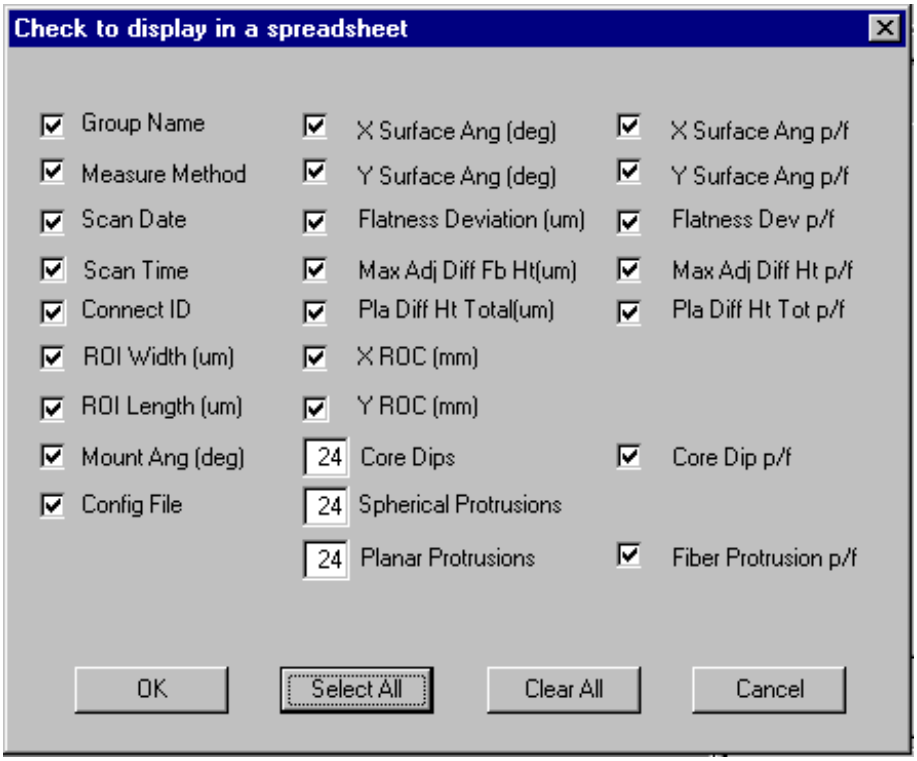
*NOTE: When not checked, use the **SAVE** or **SAVE AS** function keys to save data if desired.*

Auto Increment: When checked, the Connector ID number will automatically increase by one digit at the successful completion of a measurement.

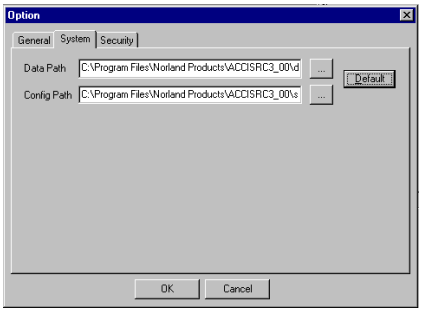
Auto Save in Database: When marked, scan results as well as scan configuration information will be automatically saved in a Microsoft Access database upon successful completion of a measurement. A captured interferometric image and the scan's 3D surface map will also be saved to a linked

Microsoft Access database if "Include Images" option has been marked by the Operator. These database files act as source for the ACCIS Report Generator as well as storage of all ACCIS Report configurations. They can also be accessed externally using Microsoft Access or standard database interface utilities. No access protections are in place on these database files so no log-on is required. Location of the database is configurable by the Operator through ACCIS main menu choice (Configuration\Option\System), setting the "Data path". The database file name is the same as the Group Name set through ACCIS main menu choice (Configuration\Option\General). The images, if selected for automatic storage, can be found by the Group Name with "_Image" appended to it. These image database files can be periodically deleted when no longer needed in order to free up disk storage space, if desired.

Spreadsheet Settings: Pressing this button will bring up a dialog box. This dialog box has a list of all data that will be saved in a spreadsheet. A checkbox is placed in front of every field to appear in a spreadsheet. Checking the box selects the field. Unchecking the box, deselects the field (data still will be saved, but will be hidden). Click on Select All button to select all checkboxes and Clear All to deselect all checked boxes. The Spreadsheet Settings option can also be used for selecting the fields that a user wants to view in a spreadsheet, when opening it with an Open command from a File Menu or XL button on a toolbar. This function is only available to ACCIS Manager-Level users.



SYSTEM (Configuration/Option/System Tab)

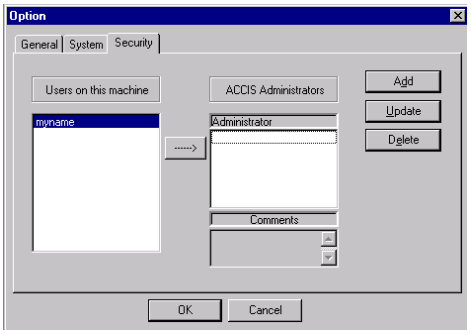


Data Path: The directory where *.nld, *.xls, and *.csv files will be stored. The Default directory is C:\Program Files\Norland Products\data. Users can change the data storage directory by typing a new directory ID into this field if desired.

Configuration Path: The directory where *.cfg files will be stored. *.cfg files are copies of user defined setups. These setups are created by pressing the Save button in the Setup Menu. These files can be loaded back into the Setup menu by pressing the Load button and selecting the appropriate file. The Default directory is C:\Program Files\Norland Products\system. Users can change the configuration directory by typing a new directory ID into this field.

The **System Option** setting can be reset to its original values by pressing the Default button.

SECURITY (Configuration/Option/Security Tab)



ACCIS supports two different levels of users, which are allowed different privileges.

Users on the machine: These are operator level users. These users cannot change the setup structure. They are permitted to load a setup configuration(***.cfg** file) that was created by a ACCIS Administrator. Some functions (e.g. Calibration-related operations) will be eliminated from the Menu choices.

ACCIS Administrators: These are manager level users. ACCIS administrators are able to access all aspects of the ACCIS program. Only ACCIS Administrators are allowed to make changes to the Settings and ACCIS Administrators list.

NOTE: New users must be entered into the Windows NT User Manager.

Configuring ACCIS Security *(*See Windows NT Manual for instructions) The first time the program is run, the only person logged on as a Network Administrator is the ACCIS Administrator. To add, remove or change ACCIS Administrators click the corresponding “Add”, “Delete” or “Update” buttons. When adding an ACCIS administrator, remember that his ACCIS username should be the same as his Network login name.To quickly add ACCIS Administrator from users who previously logged on the machine select a user you want to add in the left list box and click on the right arrow button. Changes would be in effect the next time ACCIS is executed.

CHAPTER 5 - CALIBRATION TOOLS

Norland Products has included calibration tools with the system for periodically verifying its performance. The following are short explanations of the calibration tools ***(Detailed explanations and procedures are located in the appendix).***

MAGNIFICATION CALIBRATION:

Magnification Calibration assures that the correct magnification values are being used during measurement scans. A magnification calibration standard is supplied with the interferometer for this purpose and must be used with an Edge Alignment mount. The distance between the guides holes in the connector is measured and used to obtain the correct magnification needed for the interferometer and ACCIS program. Also offered as an optional item is the NIST Traceable Magnification Calibration Reticle. This precision reticle offers a higher degree of assurance and accuracy. Magnification Calibration must be performed for both the red and white light modes.

Magnification Calibrations should be done when reliability is questionable or when fibers/guide holes do not line up with the templates.

NOTE: *Magnification Calibration can only be done by an ACCIS administrator (or by a non-administrator if a set-up configuration file with the scan type set to "Calibration" has been previously created).*

0º - 8º CALIBRATION STANDARD: (Optional)

The 0º - 8º calibration standard is used to verify the accuracy of the micrometer and the variable tilt stage. Mirror adjustments and tilt stage adjustments are made during this procedure so the calibration standard is perpendicular to the optical path. Once the calibration standard is level, it can be determined whether the micrometer and tilt stage are working correctly and if the micrometer is accurately tilting the variable tilt stage to the desired setting.

The 0º - 8º Calibration should be done whenever the accuracy of the micrometer and tilt stage are questionable or whenever any adjustments have been made to the tilt stage or mirror.

NOTE: *If measuring connectors using a Pin Alignment mount, conduct the End face Angle Calibration after the 8º Calibration Procedure.*

ENDFACE ANGLE CALIBRATION for True Angle Pin Alignment Mounts:

End face Angle Calibration (EAC) calibrates the Pin Alignment mount to the interferometer. A Pin Alignment mount (if ordered) and any relatively flat connector are used during the EAC process (ie, if calibrating an MiniMT mount, use any relatively flat Mini-MT connector for the EAC procedure. NOTE: For the MT mount, the flat 12 fiber MT connector supplied with the interferometer can be used). Mirror adjustments are made during this procedure in order for the optical path to be approximately perpendicular to the reference surface (the "ideal" surface perpendicular to the center lines of the guide holes/pins in the connector). The EAC determines X and Y angle correction factors in order for the optical path to be perfectly perpendicular to the reference surface.

When an EAC is completed, and the X and Y correction factors have been stored, single pass scans can be used rather than two pass scans for faster measurement times and higher throughput.

EAC should be done whenever any adjustments have been made to the mount, tilt stage, micrometer, or mirror.

NOTE: *EAC can only be done by an ACCIS administrator using a Pin Alignment mount. This procedure should be done using a Pin Alignment mount. Angle Calibration (AC) that can be selected on the toolbar is designed for the Advantage system and NC/AC 3005 systems w/ Fixed MIrrors and should not be used for the NC/AC 3005.*

MT REFERENCE CALIBRATION for Edge Alignment mounts: (Optional)

A stainless steel MT reference is used to calibrate the Edge Alignment mount to the interferometer. Mirror adjustments are made during this procedure in order for the optical path to be perpendicular to the flat reference surface.

MT reference calibrations should be done whenever any adjustments have been made to the Edge Alignment mount, tilt stage, micrometer, or mirror.

CHAPTER 6 - MEASURING a CONNECTOR

The Norland NC/AC 3005 is a fully automated, non-contact, interferometric microscope designed specifically for measuring the end face geometry of angled and flat array type structures, such as multiple fiber connectors and ferrules. Utilizing the new Multiple Image Overlay Software, it takes a number of measurements across the surface of the connector and stitches them together in a seamless display to provide 3D topographical information. The NC/AC 3005 w/ ACCIS software measures the radius of curvature and the angle of the end face along two axis, the planar/spherical and differential fiber height, and the flatness deviation of the connector simultaneously. The user-friendly software provides easy-to-follow instructions that are displayed on the screen.

This section provides detailed procedures, explanations, and pictures of the two main measuring processes (one pass and two pass) to familiarize our customers of what to expect from the NC/AC 3005 system. If using a Pin Alignment mount, Two Pass measurement method can be used to give the most accurate results if time and throughput is not an issue. If time and throughput are very important, conduct an End Face Angle Calibration to determine and store the Angle correction factors, and then choose One Pass w/ "Use Angle Correction". If using an Edge Alignment mount, use the One Pass W/OUT "Use Angle Correction" selected in the Set-Up screen. An End Face Angle Calibration cannot be done with an Edge Alignment mount.

The two measuring methods follow the same outline:

1. **Select the Interferometric Mode (Red or White).** The interferometric mode is dependent on the condition of the surface of the connector. NOTE: Most array type connectors require white mode.
    - Red light is used for quick analysis of smooth surfaces
    - White light is used for detailed analysis of rough surfaces or surfaces with step heights (i.e. fiber protrusion)

2. **Modify/load Set-Up parameters (F2 Set Up on tool bar or Config File on the Info Bar)** to control the data during the measurement process according to the connector being tested as well as the mount being used. Controlling the Set-up parameters is dependent on the security level of the user logged onto the system. ACCIS administrators can modify and save the set-up parameters according to customer specifications/requirements. Operator level users can only load set-up parameters previously saved by the ACCIS Administrators. (Refer to CONFIGURING DATA section for more detailed information.)

3. **Modify Connector Parameters (Configuration → Connector)** to control the data during the measurement process by indicating certain regions/fibers for removal from the data analysis. (Refer to CONFIGURING DATA – Connector Configuration for Fiber Masking for more detailed information)

4. **Modify Option parameters (Configuration → Options → General/System)** to control how the data is organized after the measurement process is completed. The data can be controlled to automatically save data to a specific group name and data path and/or automatically print the data upon completion of the scan. (Note: Auto printing only prints the display screens and results, it does not auto print reports.) Auto incrementing the Connector ID numbers can also be selected. Both ACCIS Administrators and Operator level users can modify the Option Parameters. (Refer to CONFIGURING DATA – Option parameters.)

5. **Clean connector properly** to assure accurate measurements during the scanning process. It is important to clean any residue from polishing that may have collected on the shoulder, guide pins or guide holes. Residue will give misleading and inaccurate measurements.

6. **Insert the connector properly into the mount (Edge or Pin Alignment)** to assure accurate measurements during the scanning process.
    - For Edge Alignment mounts, insert the connector into the mount so that the epoxy well is facing the back of the interferometer and that the back shoulder of the connector is resting correctly on the reference edge (the front edge of the mount).
    - For Pin Alignment mounts, inserting the connector is dependent on the measurement method. One pass measurements must have the epoxy well facing the back of the interferometer, while Two Pass measurements start with the epoxy well facing the front of the interferometer. Pin alignment mounts have proven to be more accurate in the measurement of a connector's end face angle. (Refer to MEASURING A CONNECTOR for more detail on One Pass versus Two Pass measurements.)

7. **Adjust focus knob –** If there is any difficulty in bringing the connector into view, there is a focusing scale located on the right of the superstructure. Line up the major lines to bring the connector into view.
    - Red light interferometric mode - adjust the focus knob to optimize the fringe contrast over the entire surface.
    - White light interferometric mode - adjust the focus knob so the fringe contrast is optimized at the middle of the surface (described in more detail in the FAQ's section). If it is difficult to locate the fringes, use the Red Light mode to focus, initially, because fringes are visible in more of the Live Image view. Once the fringes are located, switch back to white light.

8. **Adjust the optics** to make sure that the optical path is perpendicular to the "ideal" end face of the connector.
    - ➢ Detailed pictures and procedures for optics adjustment are located in the FAQ's section of this manual.
    - For *Two Pass*, the mirror screws are adjusted in order for the fringe patterns to be similar in both the front and back orientations of the first connector being analyzed. Do not adjust the mirror after the first connector.
    - For *One Pass W/ "Use Angle Correction"*, the mirror screws should NOT be adjusted during the measurement process. The mirror adjustment is done during an End Face Calibration, which is done prior to this measurement method.
    - For *One Pass W/OUT "Use Angle Correction"*, the mirror screws are adjusted to expand the fringe pattern so that it seems to bubble out from the center to the outer edges of the connector or vice versa during scanning.

9. **Measure the connector –** Press or click on F12 Measure to begin measurement process. Follow screen commands to completion. Results are displayed on a 2D color contour map with surface profiles displayed on the left and bottom of the map. A 3D representation can also be displayed. Measurements of angles and fiber heights are displayed in the lower left hand window.
    - NOTE: If it is difficult to center the fibers into the templates, the live image can be enlarged by double clicking on the live image. Scans can be taken with the live image enlarged. Also, the system automatically shifts the stage during measurement. The number of shifts is dependent upon the set-up parameters selected. Do not touch the connector until all segments have been measured and the stage has returned to the starting position.

At the completion of a scan, a beep is sounded to indicate the completion of frame capturing from the camera. Once the beep has sounded, the connector under test can be removed from the mount and a new connector can be inserted in preparation for the next scan. Results will be displayed when data analysis is complete.

6.1 One Pass

Step 1

- Obtain the following:
  - Computer and Monitor powered up with ACCIS software running
  - NC/AC 3005 microscope unit
  - Mount
    - **Pin Alignment** (Use Angle Correction)

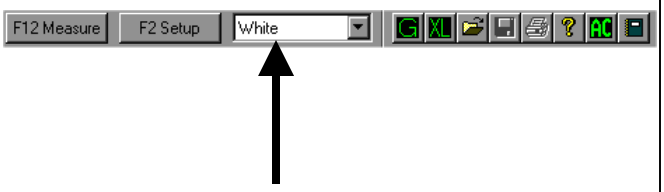
    OR
    - **Edge Alignment**
  - Alcohol & Lint free wipes or the supplied connector cleaner
  - Connectors to be analyzed

Step 2

- Do Calibrations if needed:
  - **Pin Alignment Mount**
    - Magnification calibration if the fibers do not coincide with the templates (rarely needs to be done).
    - 8º Calibration if the accuracy of the micrometer needs to be verified (only if ordered).
    - End face Angle Calibration to determine the Angle Correction factors of the mount being used for analysis.
  - **Edge Alignment Mount**
    - Magnification calibration if the fibers do not coincide with the templates (rarely needs to be done).
    - 8º Calibration if the accuracy of the micrometer needs to be verified (only if ordered).
- Refer to the CALIBRATION TOOLS section to determine which, if any, calibrations are needed. An ACCIS Administrator is needed in order for EAC and Magnification Calibration to be done.

Step 3

- Choose White Light if not already selected.

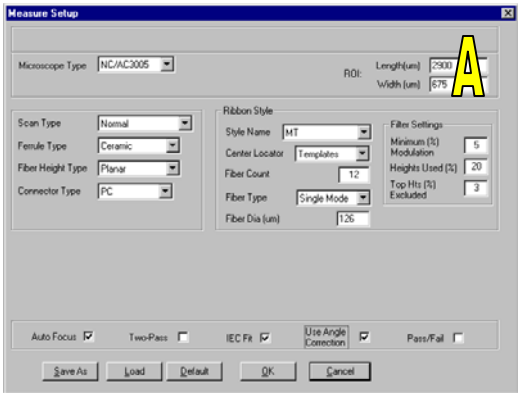


Step 4

•Select the **Set-Up Parameters** (F2 Setup) for connector to be measured and mount used (picture A):

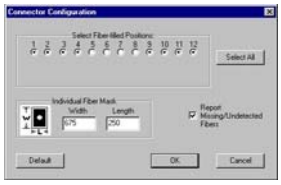
- **ACCIS Administrators** can modify setup according to the connector to be analyzed by pressing "F2" on the toolbar or keyboard. Administrators can save the set-up as Config Files by pressing "Save As." Refer to CONFIGURING DATA -Recommended Set Up parameters and Pass/Fail parameters.
  - Click "OK" to save and exit.
- **Operator level** users will have to do the following:
  1. Click on ConfigFile button on the Info Bar.
  2. Select the Set-Up configuration appropriate to the connector being analyzed.

•Select the **Connector Configuration** Parameters (Configuration→Connector) according to the connector being tested (picture B). Refer to CONFIGURING DATA – Connector Configuration for Fiber Masking.



NOTE: Set Up parameters for One Pass w/ "Use Angle Correction" shown for an MT 12 fiber connector.

B

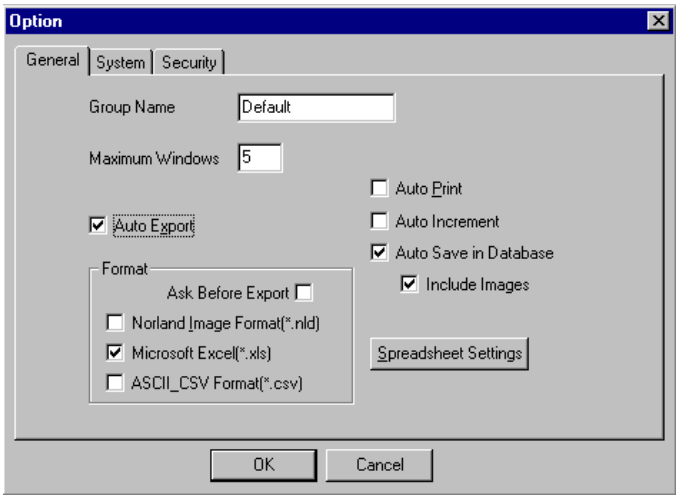


Step 5

•Click on Configuration/Option/General Tab

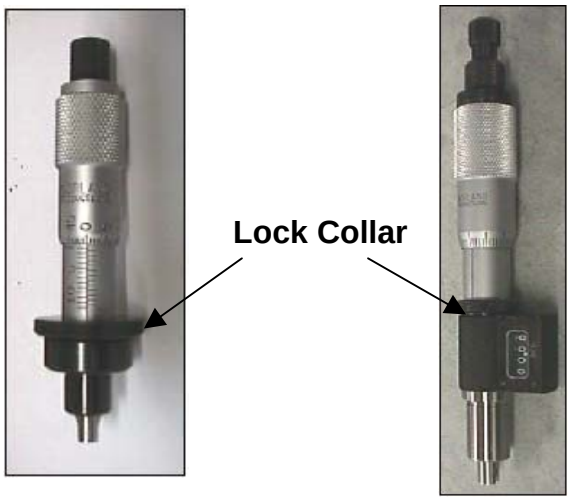
- Enter the Group Name data is to be stored under. (Can also be done by pressing G on the toolbar.)
- Select Auto Save, Auto Increment, and/or Auto Print if desired.
  - If Auto Save is activated, select desired format into which data will be saved.
    - Click on Spreadsheet settings and choose field to be shown on the Excel Spreadsheet if Auto Save to Excel chosen.
- Note: The ACCIS program will save all data information, but will hide them if not selected.

•Click "OK" when done.



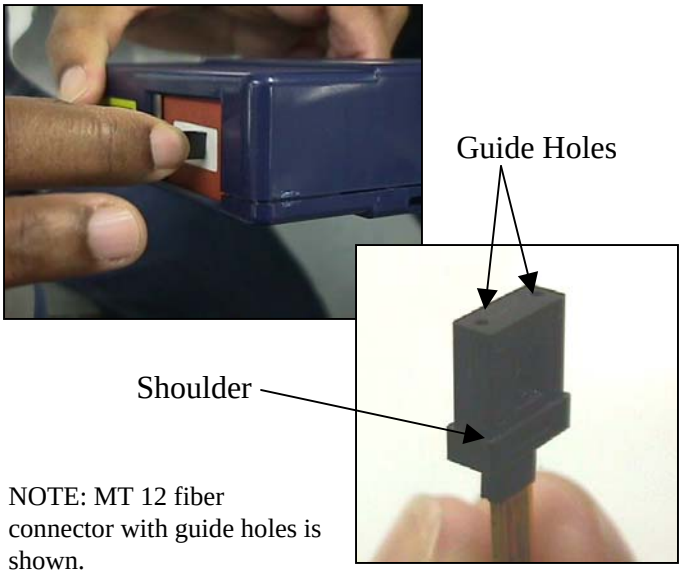
Step 6

- If measuring **PC** connectors:
  - Verify that the lock collar is in the unlocked position by turning the lock collar counterclockwise.
  - Set the micrometer to 0.0
  - Lock the micrometer position by turning the lock collar clockwise.
- If measuring **APC** connectors:
  - Verify that the lock collar is in the unlocked position by turning the lock collar in a counter clockwise direction
  - Turn the micrometer clockwise to the degree of the polish indicated by the mount angle in the Set-Up menu.
  - Lock the micrometer position by turning the lock collar clockwise.



Step 7

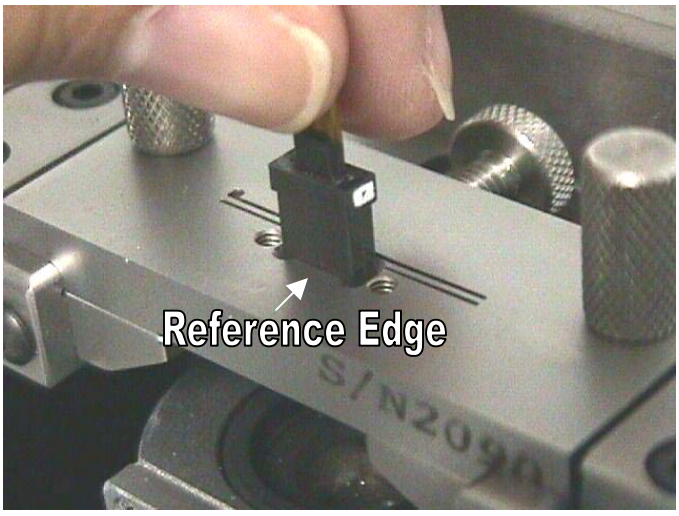
- Clean the connector with the connector cleaner supplied.
  - Alcohol and a lint free wipe can be used instead of the connector cleaner is desired. Make sure any alcohol on the connector is wiped off before inserting the connector in the mount.
- For **Pin Alignment mounts**, make sure the guide holes or pins are clean.
- For **Edge Alignment mounts**, make sure the shoulder on the back of the connector is clean.



NOTE: MT 12 fiber connector with guide holes is shown.

Step 8

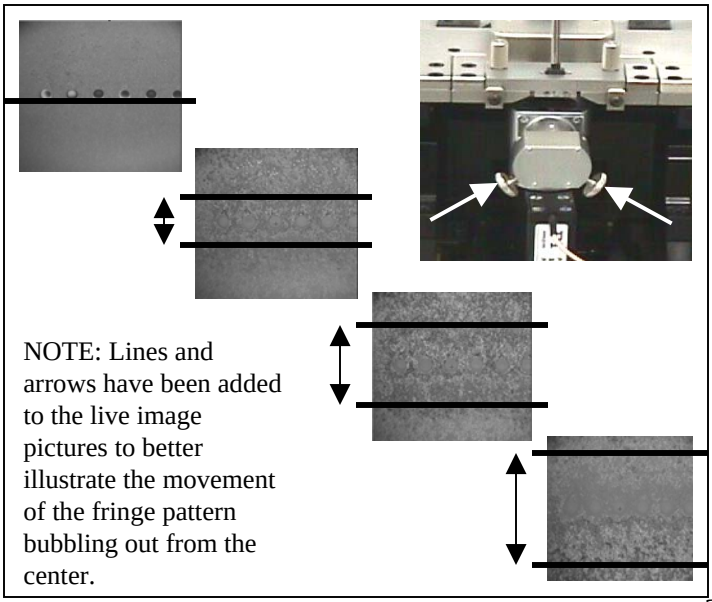
- Insert the connector into the mount with the epoxy well facing the back of the interferometer.
  - •If using a **Pin Alignment mount**:
    - •Make sure the guide holes/pins of the connector are correctly placed on the guide pins/holes of the mount. If inserted incorrectly, the guide pins in the mount/connector may be damaged.
  - •If using an **Edge Alignment mount**:
    - •Make sure there is no play between the mount and the connector, adjust the screw on the mount so the connector is held snuggly in place and that the back shoulder of the connector lies flat on the reference edge. Make sure it is not too tight that it damage the connector when inserting/removing the connector from the mount.
- Push the connector all the way down into the mount by applying equal pressure on the left and right side of the connector.



NOTE: An Edge Alignment mount is shown

Step 9

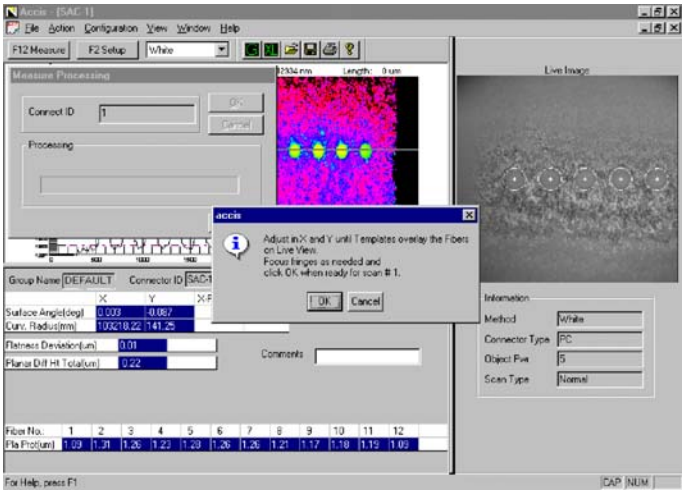
- If using a **Pin Alignment Mount**, move onto Step 10.
- If using an **Edge Alignment Mount**:
  - •Adjust the mirror knobs (indicated by arrows in the picture) one at a time to expand the fringe pattern over the surface of the connector so that it seems to bubble out from the center of the connector or vice versa when adjusting the focus knob.
    - •NOTE: The mirror is VERY sensitive to even the slightest movement of the mirror screws, so be very gentle when turning them.



NOTE: Lines and arrows have been added to the live image pictures to better illustrate the movement of the fringe pattern bubbling out from the center.

Step 10

- Press “F12 Measure” on the Tool Bar.
- Follow the command prompt.
  - Adjust the focus knob to move the fringe pattern out of view.
  - Adjust the X and Y knobs to place the fibers in the center of the templates. NOTE: If it is difficult to center the fibers into the templates, the live image can be enlarged by double clicking on the live image. Scans can be taken with the live image enlarged.
  - Adjust the focus knob as indicated.
  - Press OK
- If desired, the Connector ID can be changed while the scan is in progress. Click on OK after the Connector ID has been changed.
  - Make sure not to cause any vibrations



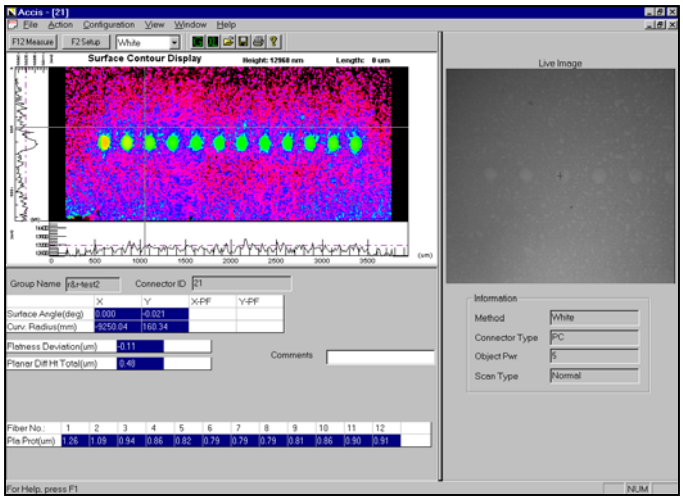
Step 11

- The interferometer may go through a few scans to measure and map the surface of the connector.
- If Auto Focus is selected in Set-Up parameters:
  - The program will determine the range to scan and automatically go through the scanning procedure from beginning to end. Occasionally, the auto-focus may fail. If it does, adjust the focus knob to bring the fringe pattern into view and click RETRY. If it fails again, click on CANCEL to allow the interferometer to scan the entire region.
- If Auto Focus is NOT selected, the interferometer will scan through the entire range in sections, stop between sections, and ask the operator to manually refocus if needed.

accis
Problem applying Autofocus. Please adjust focus to bring fringes back into view. Then click RETRY to perform Autofocus again, or click CANCEL to skip Autofocus and proceed to scanning.
Retry
Cancel

Step 12

- When the scan is completed, the results will be shown on a Surface Contour Display.
  - If Auto-Save or Auto Print is selected, the operator will be prompted at the completion of a scan whether or not to save or print the data.
  - If Auto-Save or Auto Print is NOT selected, the program will only show the results



Step 13

- Remove the connector from the mount and move it onto the next step in the process line depending on whether the connector passes/fails.
  - ACCIS Administrator can set-up Pass/Fail criteria. Refer to Configuration Section of this manual for more detailed information.
- Repeat Steps 7-12.

6.2 Two Pass

Step 1

- Obtain the following:
  - Computer and Monitor powered up with ACCIS software running
  - NC/AC 3005 microscope unit
  - Pin Alignment mount
  - Alcohol & Lint free wipes or the supplied connector cleaner
  - Connectors to be analyzed

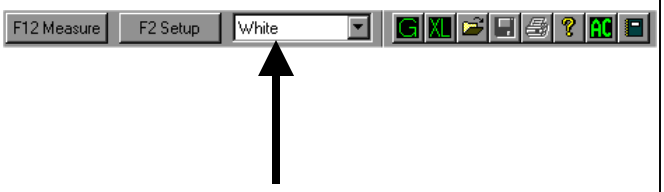
NOTE: This procedure should not be conducted using an Edge Alignment mount or APC connector.

Step 2

- Do Calibrations if needed.
  - Magnification calibration if the fibers do not coincide with the templates (rarely needs to be done).
- Refer to the CALIBRATION TOOLS section to determine which, if any, calibrations are needed. An ACCIS Administrator is needed in order for EAC and Magnification Calibration to be done.

Step 3

- Choose White Light mode if not already in it.



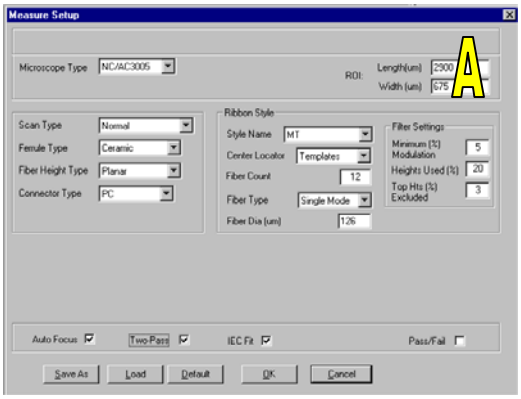
Step 4

•Select the **Set-Up Parameters** (F2 Setup) for connector to be measured and mount used (picture A):

- •**ACCIS Administrators** can modify setup according to the connector to be analyzed by pressing "F2" on the toolbar or keyboard. Administrators can save the set-up as Config Files by pressing "Save As." Refer to CONFIGURING DATA -Recommended Set Up parameters and Pass/Fail parameters.
  - •Click "OK" to save and exit.
- •**Operator level** users do the following:
  1. Click on ConfigFile button on the Info Bar.
  2. Select the Set-Up configuration appropriate to the connector being analyzed.

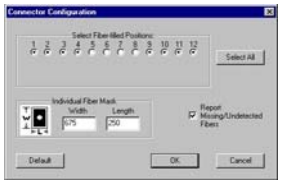
•Select the **Connector Configuration** Parameters (Configuration→Connector) according to the connector being tested (picture B). Refer to CONFIGURING DATA – Connector Configuration for Fiber Masking.

- •The connector configuration must be symmetrical.



NOTE: Set Up parameters for Two Pass shown for an MT 12 fiber connector.

B

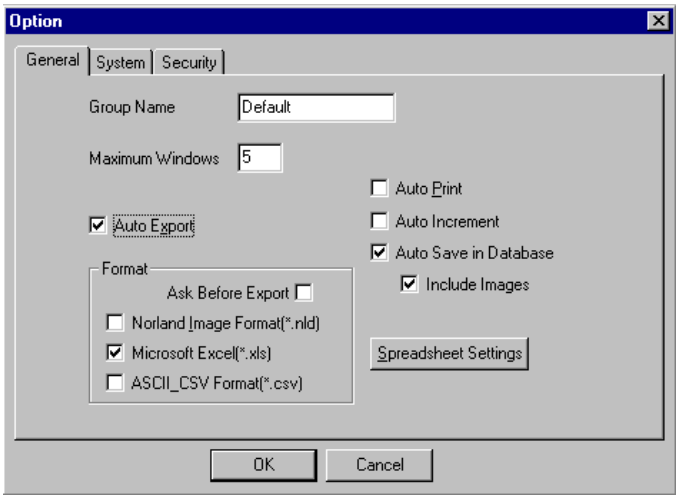


Step 5

•Click on Configuration/Option/General Tab

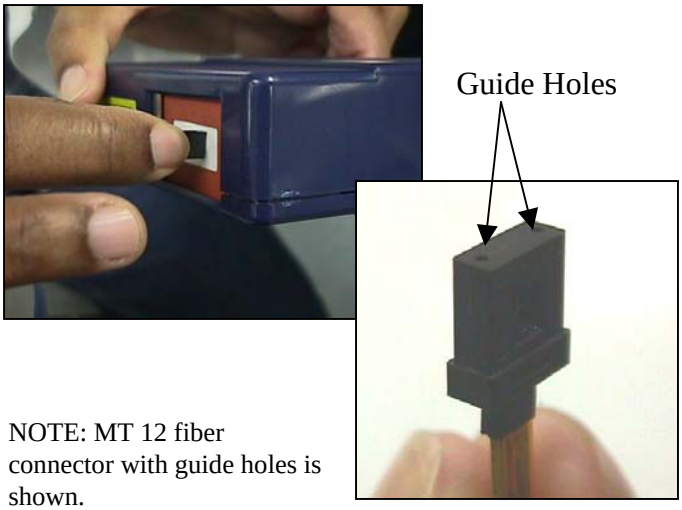
- •Enter the Group Name data is to be stored under. (Can also be done by pressing G on the toolbar.)
- •Select Auto Save, Auto Increment, and/or Auto Print if desired.
  - •If Auto Save is activated, select desired format into which data will be saved.
    - •Click on Spreadsheet settings and choose field to be shown on the Excel Spreadsheet if Auto Save to Excel chosen. Note: The ACCIS program will save all data information, but will hide them if not selected.

•Click "OK" when done.



Step 6

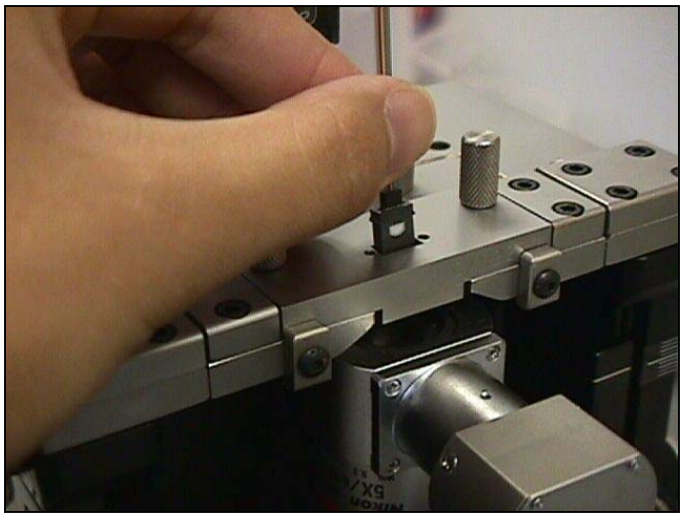
- Clean the connector with the connector cleaner supplied.
  - Alcohol and a lint free wipe can be used instead of the connector cleaner is desired. Make sure any alcohol on the connector is wiped off before inserting the connector in the mount.
- Make sure the guide holes or pins are clean.



NOTE: MT 12 fiber connector with guide holes is shown.

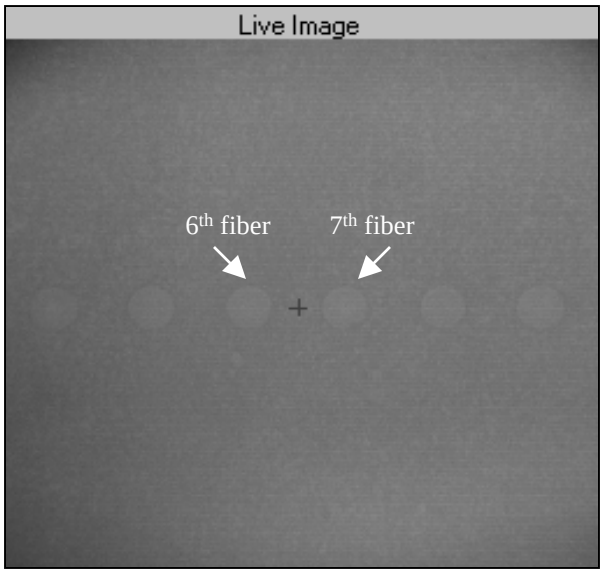
Step 7

- Insert the connector into the mount with the epoxy well facing the front of the interferometer.
  - Make sure the guide holes/pins of the connector are correctly placed on the guide pins/holes of the mount. If inserted incorrectly, the guide pins in the mount/connector may be damaged.
- Push the connector all the way down into the mount by applying equal pressure on the left and right side of the connector.



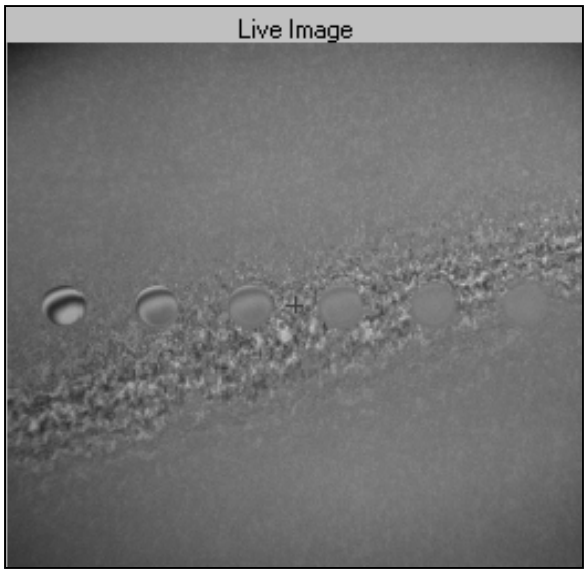
Step 8

- Adjust the X and Y knobs until the crosshairs lie between the 6th and 7th fibers (the middle of the connector) in the Live Image Screen.



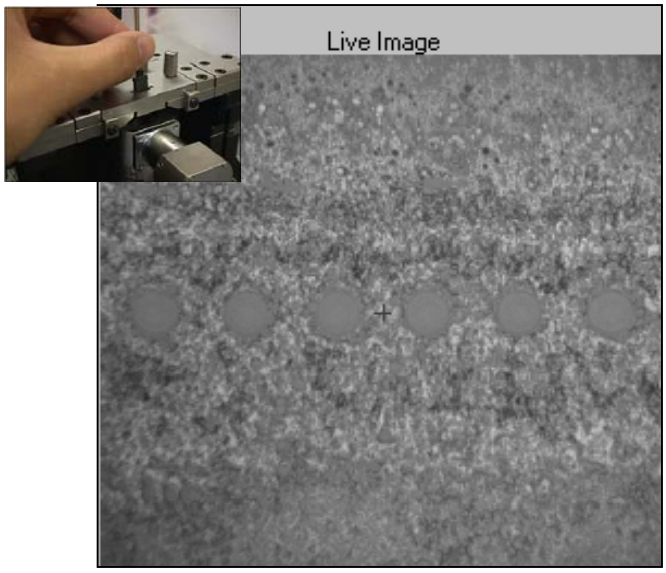
Step 9

- Adjust the Z focus knob to bring the fringe pattern to the center of view in the Live Image Screen.
  - The fringe pattern can be in any direction/orientation on the screen.
- Note approximately how much of the live image the fringe pattern takes up.
  - For example, the fringe pattern takes up approximately 10% of the live image screen.



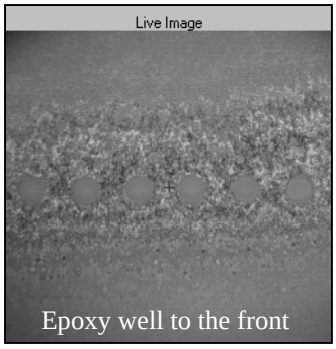
Step 10

- Rotate the connector 180º so that the epoxy well is facing the back of the interferometer.
- Adjust the Z focus knob to bring the fringe pattern to the center of view in the Live Image Screen.
  - The fringe pattern can be in any direction/orientation on the screen.
- Note approximately how much of the live image the fringe pattern takes up.
  - For example, the fringe pattern takes up approximately the entire screen.



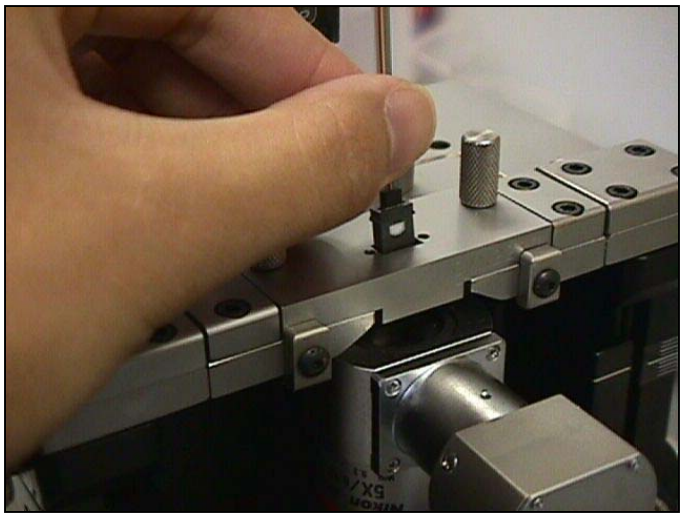
Step 11

- Turn the connector to the orientation that has the smaller fringe pattern. (In this case, the epoxy well to the front.)
  - Adjust the mirror knobs to expand the fringe pattern to take up an average % of the areas from steps 9 and 10.
    - NOTE: The mirror is VERY sensitive to even the slightest movement of the mirror screws, so be very gentle when turning them.
  - Rotate the connector 180º to check the fringe pattern in the other direction. (The fringe pattern can be in any direction/orientation on the screen.)
- Rotating the connector and adjusting the mirror may have to be done a few times until the fringe pattern is equal in both the front and back orientations. DO NOT TOUCH THE MIRROR KNOBS AFTER THEY HAVE BEEN ADJUSTED!



Step 12

- Rotate the connector so that the epoxy well is facing the front of the interferometer.



Step 13

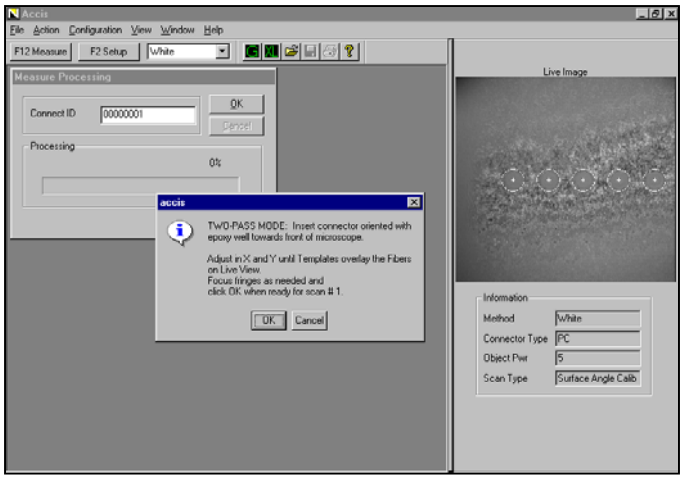
•Press “F12 Measure” on the Toolbar or F12 on the keyboard.

•Follow the command prompt.

- •Adjust the focus knob to move the fringe pattern out of the view.
- •Adjust the X & Y knobs to place the fibers in the center of the templates.
  - •Make sure the leftmost fiber is located in the leftmost template.
  - •NOTE: If it is difficult to center the fibers into the templates, the live image can be enlarged by double clicking on the live image. Scans can be taken with the live image enlarged.
- •Adjust the focus knob to bring the fringe pattern into the center of the live image screen
- •Press OK

•If desired, the Connector ID can be changed while the scan is in progress. Click on OK after the Connector ID has been changed.

- •Make sure not to cause any vibrations.



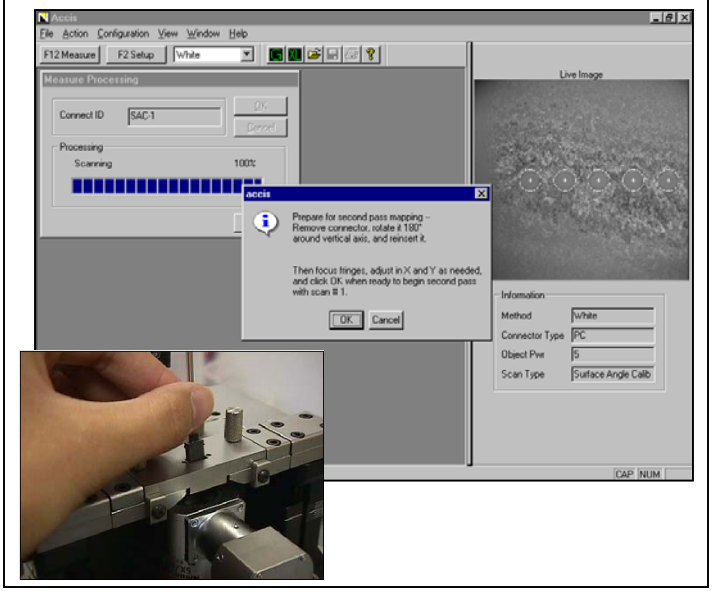
Step 14

- The interferometer may go through a few scans to measure and map the surface of the connector.
- Occasionally, the Auto Focus may fail. If it does, adjust the focus knob to bring the fringe pattern into view and click RETRY. If it fails again, click on CANCEL to allow the interferometer to scan the entire region.

accis
Problem applying Autofocus. Please adjust focus to bring fringes back into view. Then click RETRY to perform Autofocus again, or click CANCEL to skip Autofocus and proceed to scanning.
Retry
Cancel

Step 15

- When the scan is completed, follow the command prompt that appears.
  - Rotate the connector 180º so the epoxy well is facing the back of the interferometer.
  - Adjust the focus knob to bring the fringe pattern out of view.
  - Adjust the X & Y knobs to put the fibers into the center of the templates.
  - Adjust the focus knob to bring the fringe pattern into the center of the live image screen.
  - Press OK



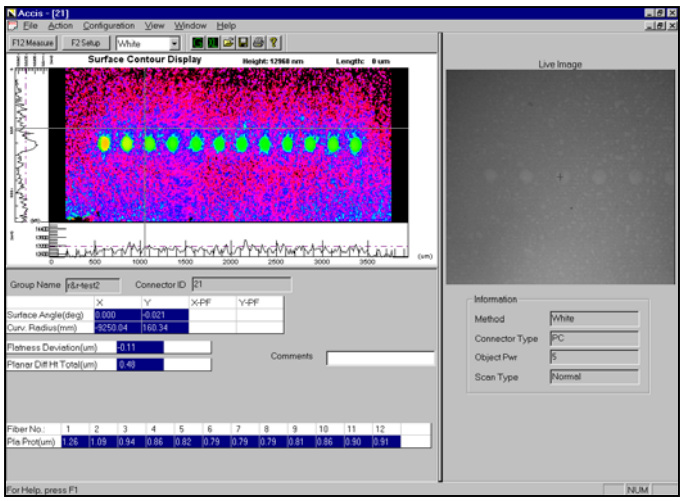
Step 16

- The interferometer may go through a few scans to measure and map the surface of the connector.
- Occasionally, the Auto Focus may fail. If it does, adjust the focus knob to bring the fringe pattern into view and click RETRY. If it fails again, click on CANCEL to allow the interferometer to scan the entire region.

accis
Problem applying Autofocus. Please adjust focus to bring fringes back into view. Then click RETRY to perform Autofocus again, or click CANCEL to skip Autofocus and proceed to scanning.
Retry
Cancel

Step 17

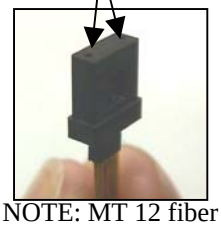
- When the scan is completed, the results will be shown on a Surface Contour Display. The angle will be an average of the two orientations and the fiber heights will be according to the orientation of the connector with the epoxy well facing the back of the interferometer.
  - If Auto-Save or Auto Print is selected, the operator will be prompted at the completion of a scan whether or not to save or print the data.
  - If Auto-Save or Auto Print is NOT selected, the program will only show the results
- Remove the connector from the mount.



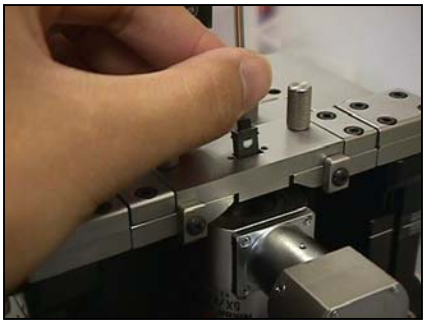
Step 18

- Clean the next connector with the connector cleaner supplied.
  - Alcohol and a lint free wipe can be used instead of the connector cleaner is desired. Make sure any alcohol on the connector is wiped of before inserting the connector in the mount.
  - Make sure the guide holes or pins are clean.
- Insert the connector into the mount with the epoxy well facing the front of the interferometer.
  - Make sure the guide holes/pins of the connector are correctly placed on the guide pins/holes of the mount. If inserted incorrectly, the guide pins in the mount/connector may be damaged.
- Push the connector all the way down into the mount by applying equal pressure on the left and right side of the connector.
- Repeat steps 13-18

Guide Holes



NOTE: MT 12 fiber connector with guide holes is shown.

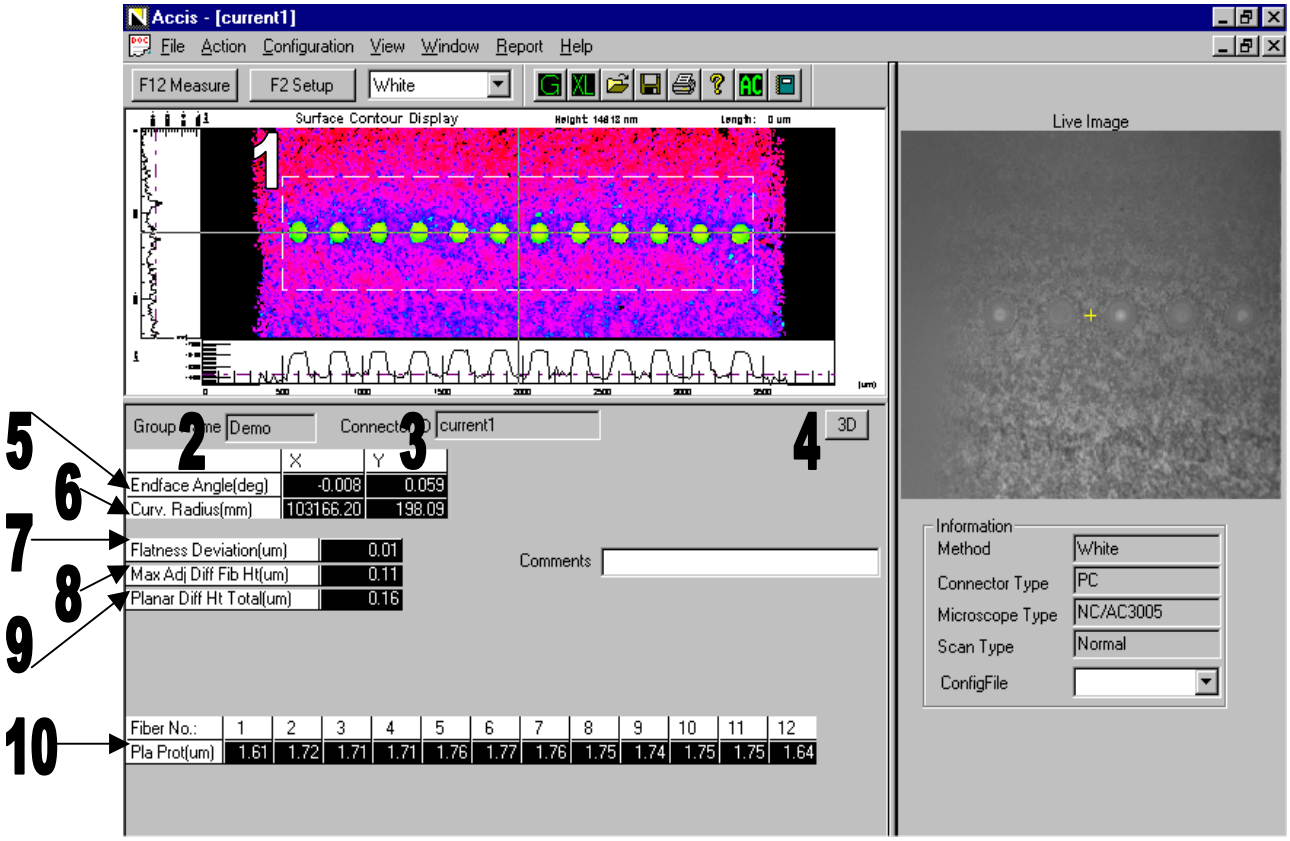


CHAPTER 7 – DATA INTERPRETATION

At the completion of a successful scan, a Surface Contour Display appears on the screen giving the following information:

1. Contour map
2. Group Name
3. Connector ID
4. 3D Display
5. End face Angle(º) along the X & Y axis
6. Radius of Curvature (mm) along the X & Y axis
7. Flatness Deviation (µm)
8. Maximum Adjacent Differential Ht (µm)
9. Planar Differential Ht (µm)
10. Planar or Spherical Protrusion (µm)
11. Core Dip (if Multimode fiber is selected in the Set-Up menu)

NOTE: If Fiber Masking was conducted, the Surface Contour Displays will show the Region of Interest and any Masked Fiber regions. Please refer to CONFIGURING DATA-Connector Configuration for Fiber Masking.



1. CONTOUR MAP

The contour map is displayed in the upper left of the screen showing the surface of the end face of the connector. Assuming that the connector is positioned in the mount so that the epoxy well is facing the back of the interferometer, the front right corner of the connector (marked with the star in FIGURE 1) corresponds to the upper left corner of the contour map (marked by the star in FIGURE 2). The fibers numbers are labeled 1 to n (where n = the total number of fibers being measured) from left to right on the contour map as shown in FIGURE 2, which corresponds to the connector as shown in FIGURE 1. Different colors signify different heights of the points analyzed during the measurement process.

Along the bottom and to the left of the contour map, are the X and Y axis respectively. The axis show the heights of the points analyzed during the measurement process. The data shown on the X and Y axis correspond to the location of the crosshairs on the contour map. The height of the intersection of the crosshairs is shown at the top of the surface contour map in the **Height** field. In order to move the location of the crosshairs, use the arrows on the keyboard or the right mouse button. The arrow buttons will move the crosshairs in small increments in the direction of the arrow button pressed. The right mouse button will move the crosshairs to whatever position the cursor is on the contour map.

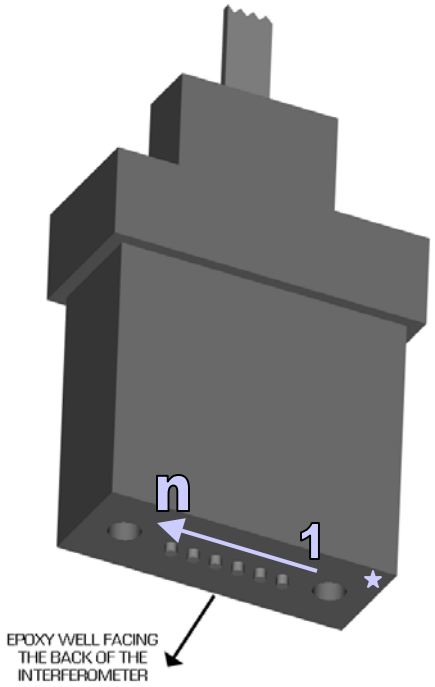


FIGURE 1.

The distance between two points can also be determined by the use of the mouse. Click and hold down the right mouse button on the first point, drag the mouse to the second point and release the right mouse button. The distance between the two points is shown in the upper right corner of the contour map in the **Length** field. The height difference in reference to the first point is also shown in the **Height** field to the left. To bring the crosshairs back to the center of the contour map, press the home button on the keyboard.

The best fit plane used as a reference for planar fiber height measurements is displayed in the X and Y axis sections as a dashed purple line.

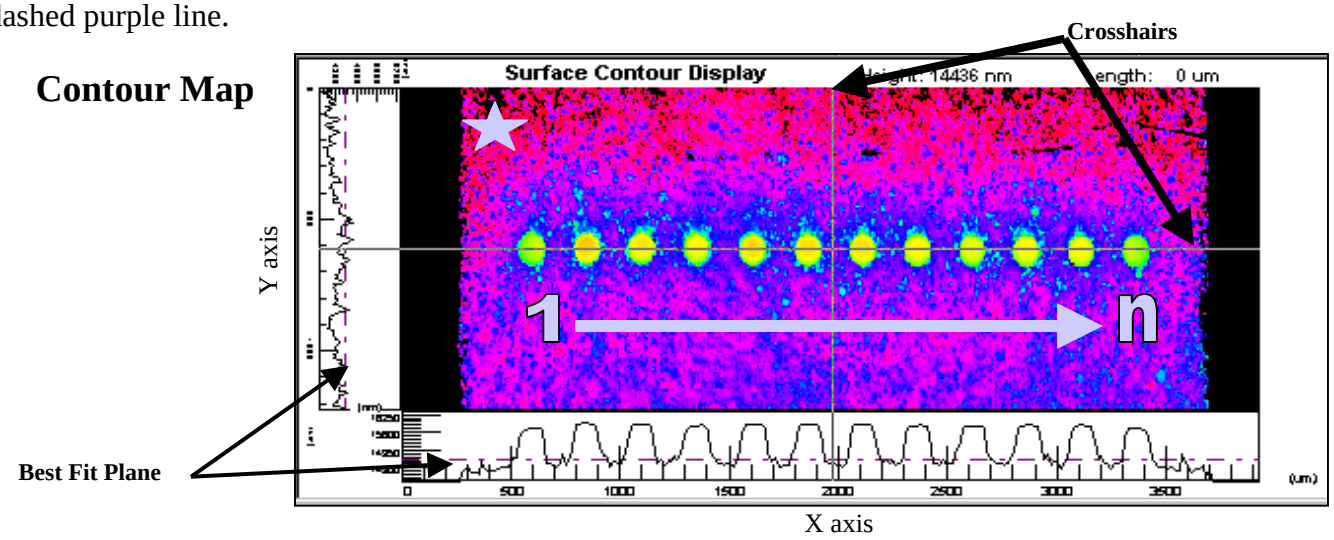


FIGURE 2.

2. GROUP NAME

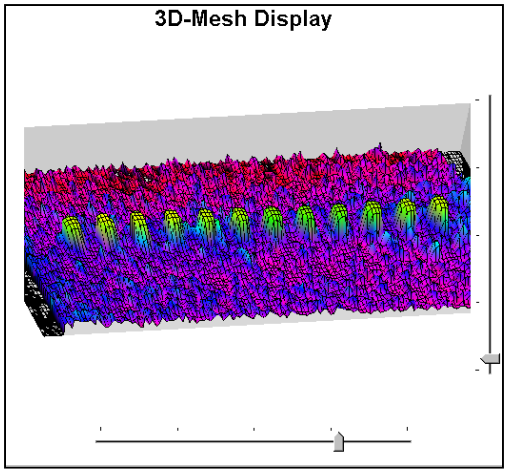
Displays the name of the Excel Spreadsheet that the data is saved to. Can be entered/modified in **Configuration → Option → General** or the toolbar button **G** before the measurement process.

3. CONNECTOR ID

Displays the name of the measurement scan. Will increment automatically if Auto Increment is selected in **Configuration → Option → General**.

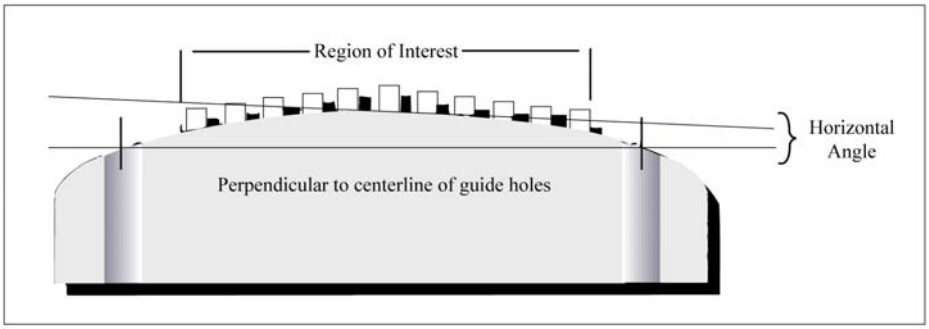
4. 3D DISPLAY

Clicking the "3D" button will activate a new window containing a three-dimensional representation of the scanned connector endface. This can be viewed at different angles by manipulating the horizontal and vertical slide bars. Close this window by double-clicking anywhere in the window, or by using the "File\Close" menu function.



5. ENDFACE ANGLE (°)

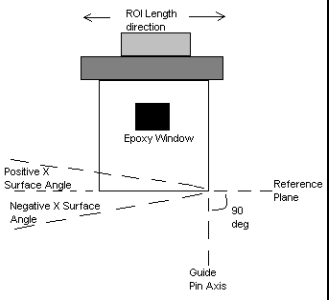
Displays the X and Y End face Angle of the end face of the connector in degrees (º) compared to the ideal end face (the plane perpendicular to the center lines of the guide holes/pins). NOTE: If performing a one pass with an Edge Alignment mount, the results indicate an angle with respect to the microscope objective reference mirror.



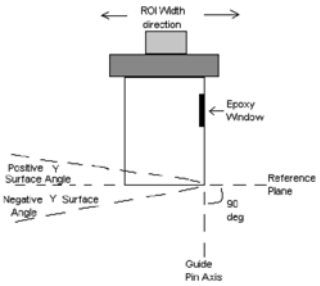
5. ENDFACE ANGLE (cont.)

SIGN CONVENTION of ENDFACE ANGLE MEASUREMENTS

A positive **X-End face Angle** indicates a trend of increasing end face height as one moves from the Left side of the Contour Map to the Right Side of the Contour Map.



A positive **Y-End face Angle** indicates a trend of decreasing end face height as one moves from the bottom of the Contour Map to the top of the Contour Map.

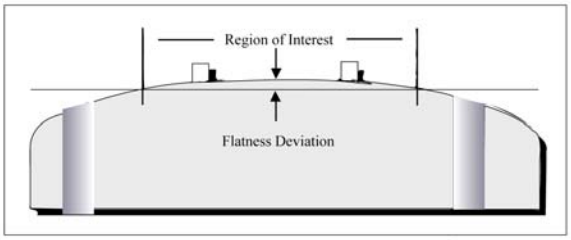


6. RADIUS of CURVATURE (mm)

Displays the X and Y radius of curvatures determined by fitting an ideal bi parabolic plane to the actual surface of the connector over the Region of Interest.

7. FLATNESS DEVIATION (μm)

Indicates how flat the surface is over the Region of Interest. It is the difference in the height at the center of the connector between the best fit plane over the region of interest and the best fit bi-parabolic curve to the data points according to the filter settings in the Set Up menu.

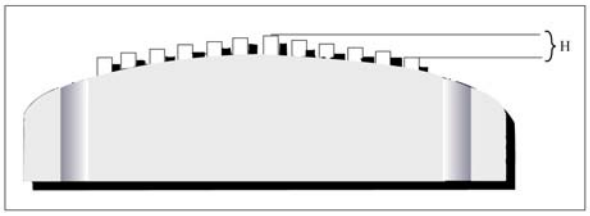


8. MAXIMUM ADJACENT DIFFERENTIAL HEIGHT (μm)

Indicates the maximum difference in planar fiber height measurement found between two adjacent fibers.

9. PLANAR DIFFERENTIAL HEIGHT (μm)

Indicates the difference between the highest and lowest protruding fibers.



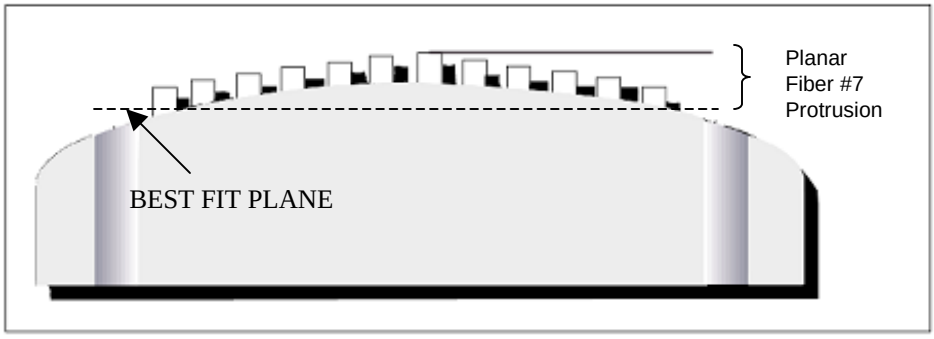
10. FIBER PROTRUSION

PLANAR - Indicates the distance between the height of the fiber and the best fit plane over the region of interest. (IEC recommended)

SIGN CONVENTION:

+p → protrusion

- p → undercut

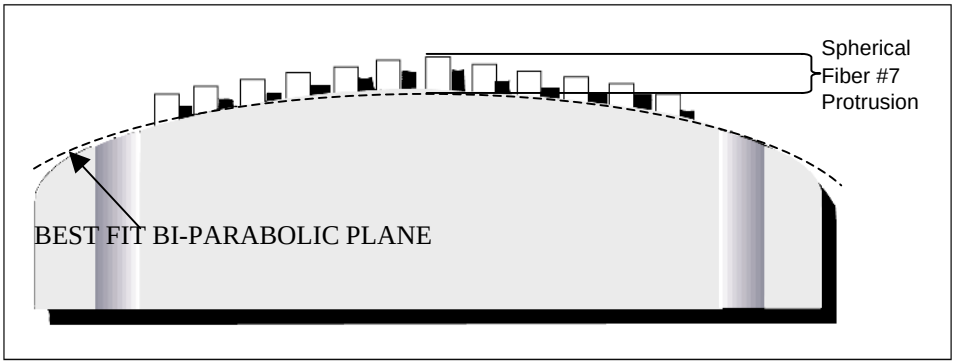


SPHERICAL – Indicates the difference between the height of the fiber and the final best fitting bi-parabolic surface.

SIGN CONVENTION

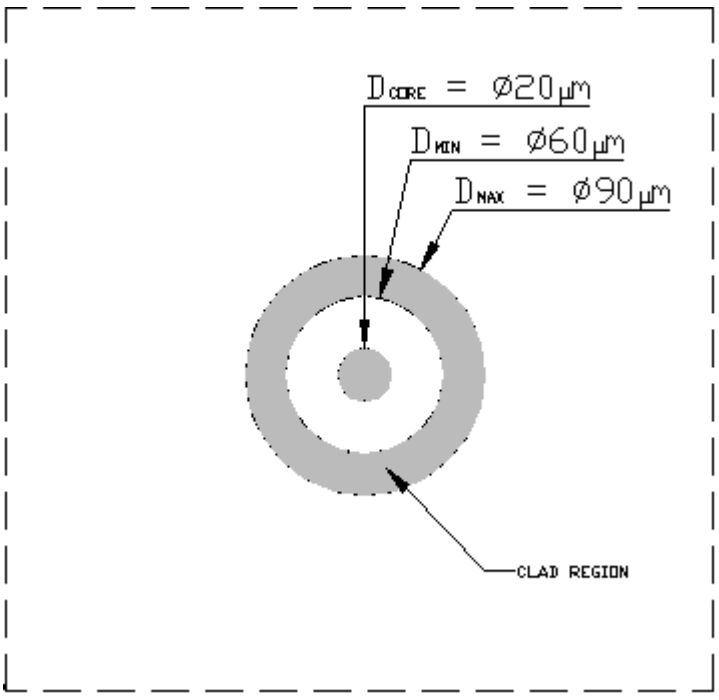
+p → protrusion

- p → undercut



11. CORE DIP (only when Multimode is selected in the Set Up menu)

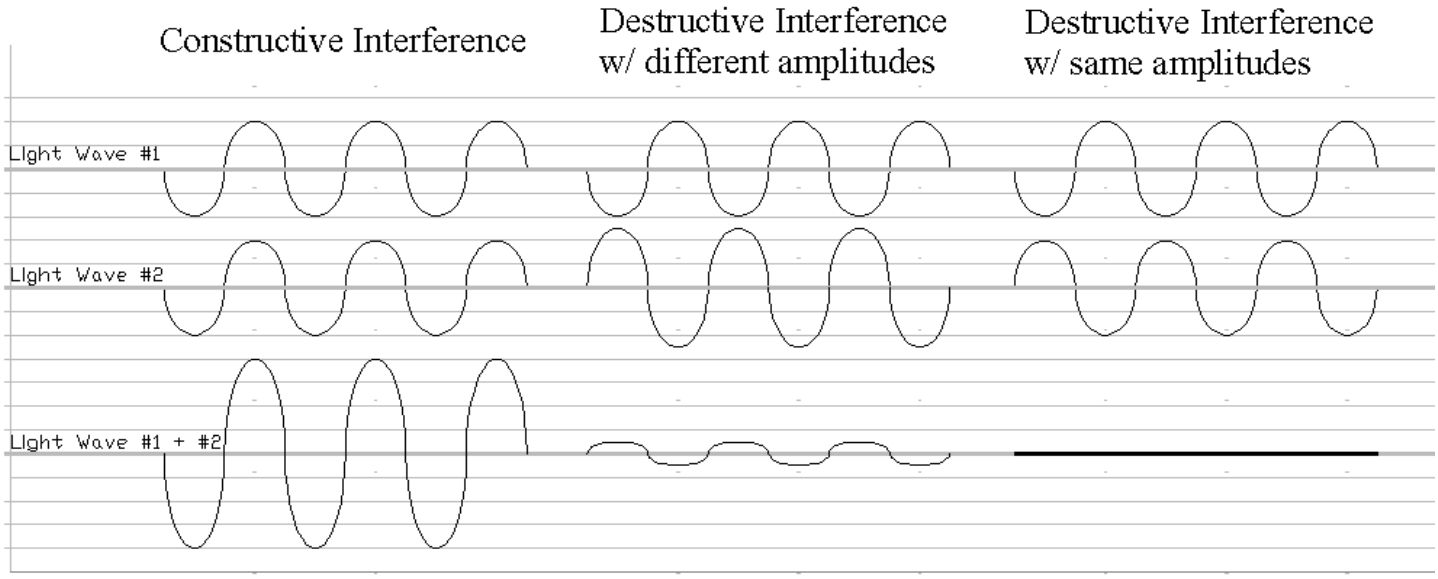
Indicates the height difference between the two shaded regions (corresponding to the clad and core regions) on the end face of a fiber as shown below. The heights within the two regions are averaged, and the difference between the two regions is known as the Core Dip.



The core material in a fiber tends to be softer than the clad material and therefore polishes away quicker than the cladding material. Since multifiber connectors have a larger core diameter than single fiber connectors, it is important that there is not a significantly large height difference between the core region and clad region, which may affect the amount of light transmission between two connectors. There are industry standards for the regions indicated. The illustration follows industry standards:

CHAPTER 8 - INTERFEROMETRY BASICS

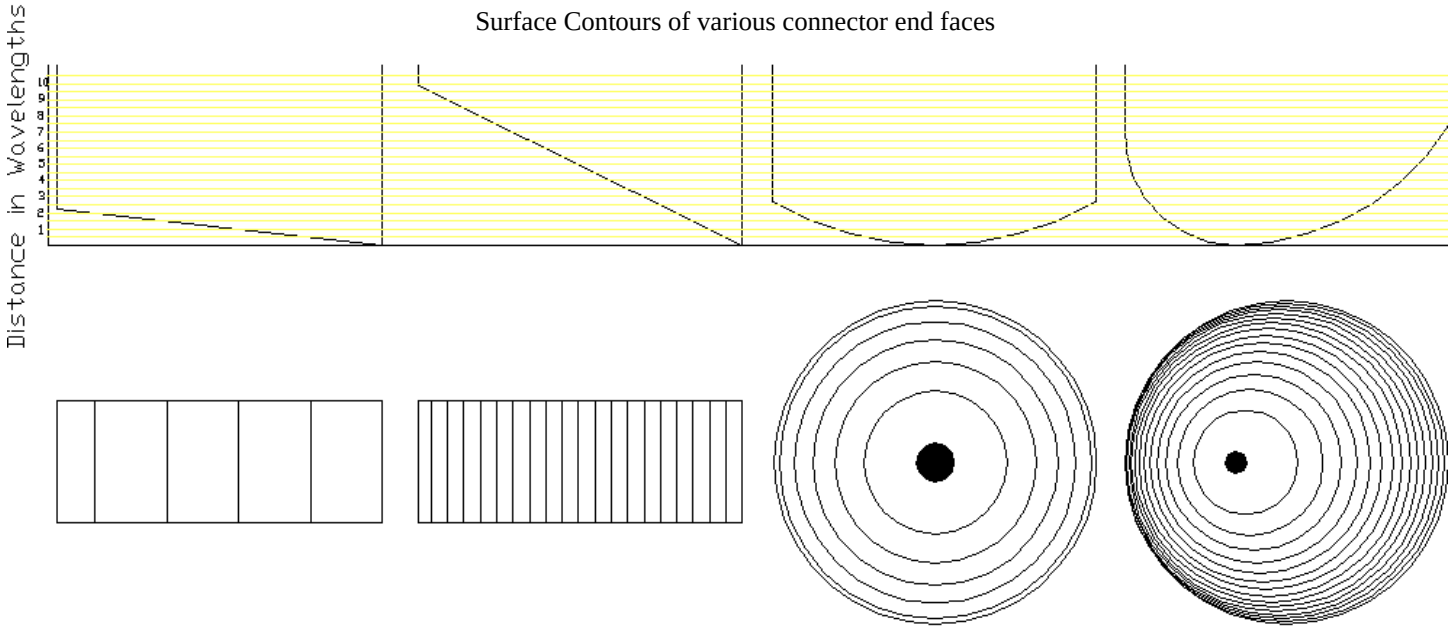
Light wave interference occurs when two or more waves of the same frequency or wavelength combine to form a single wave whose amplitude is the sum of the amplitudes of the combined waves. Constructive and Destructive interference is the most striking examples of light wave interference. Constructive interference occurs when the light waves are completely in phase with each other (the peak of one wave coincides with the peak of the other wave). Destructive interference occurs when the light waves are completely out of phase with each other (the peak of one wave coincides with the trough of the other wave). Refer to figure below for an illustration of Constructive and Destructive interference.



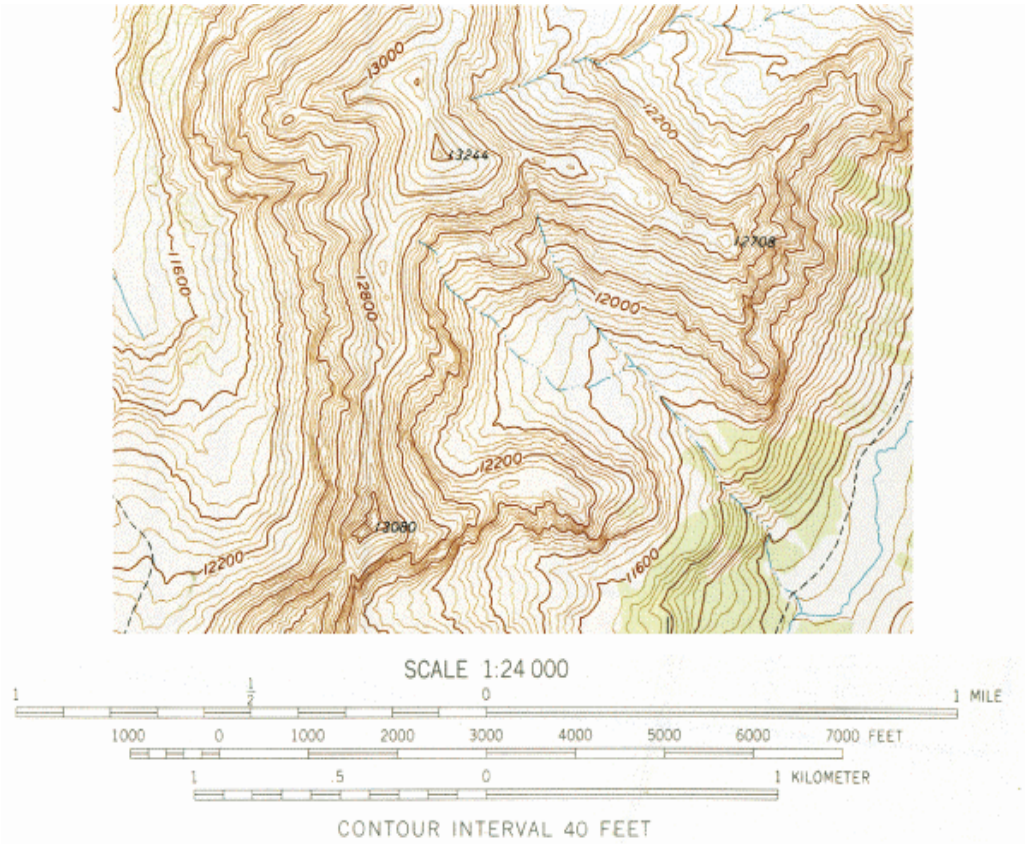
Interferometers can produce images and data to sub micron accuracy using the principle of wave interference. Interferometers use a single coherent light source. In order to produce two separate light waves for interference to occur, a partially reflective beamsplitter is used. As the light hits the beamsplitter, one wave front is transmitted through the beamsplitter, though an objective lens, and to the object being examined. The other light wave reflects off of the beamsplitter onto a stationary reference mirror. After both light waves are reflected off of the surfaces (the surface of the object being examined and the reference mirror), the waves combine to produce constructive and destructive interference waves, also known as light and dark fringes respectively. Each dark fringe

identifies a specific height on the surface of the object being examined. Typically, two adjacent dark fringes have a height difference of λ/2 of the light being used and can thus show a surface contour of the connector end face, very similar to the concept of Contour maps which are used to show the different elevations of a land surface.

Surface Contours of various connector end faces

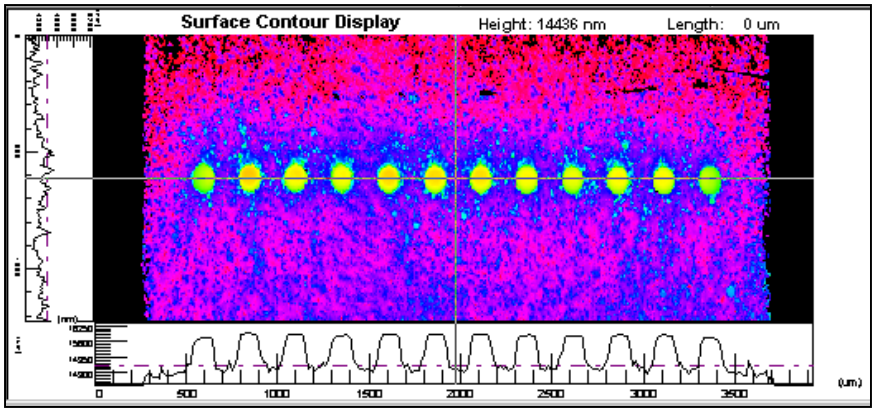


Surface Contour of area of land

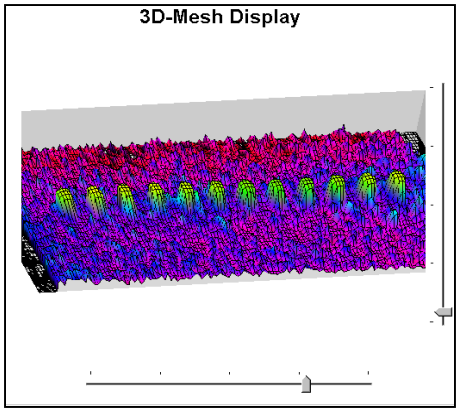


Phase-shift Interferometry goes a step further by using piezo-electric devices to “shift” the interference pattern. It compares the changing images to the initial fringe pattern to determine the physical coordinates for every point on the surface. As a result, the distance and direction between any points on the surface can be measured and the information can be displayed as a 3D image to visualize the entire surface or as cross sectional profiles for a simpler perspective. Below are a few examples of the different images that can be obtained.

Multi-fiber Images

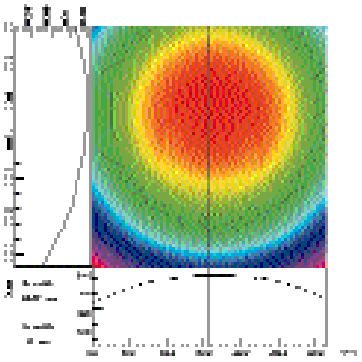


Contour Display with X and Y profiles.

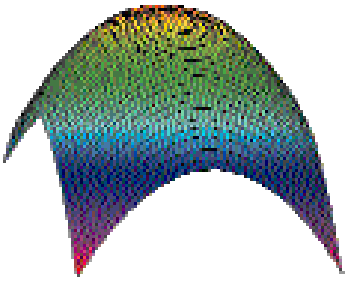


3D Mesh

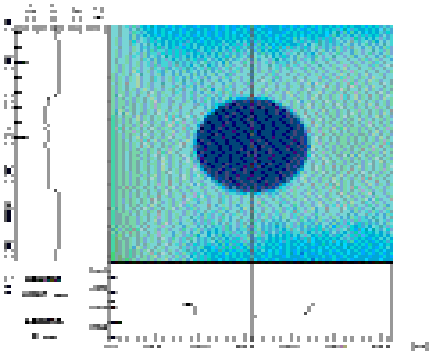
Single fiber Images



Contour Display provides a color coded contour of the surface as well as a cross sectional view.



3D Mesh Display helps the user visualize the surface under inspection.



Surface Fit plots the difference between the actual and the ideal surface to zoom in on minute details.

CHAPTER 9 - CARE & MAINTENENCE

Your Norland Automated Interferometer is designed primarily for use at a fixed workstation supplied with a three wire, grounded power outlet. Do not cut or bypass the plug's grounding prong. Any attempt to operate or service the computer without an adequate ground may result in serious personal injury and/or damage to the system. In the event that it proves necessary to move your unit to another location, or to ship it to another facility, use the following guidelines to prevent damage to your *NC/AC 3005*.

Cleaning the CPU, Monitor, and Interferometer

Use a damp, lint-free cloth to clean the computer unit and monitor. Avoid, at all costs, abrasives or solvents as they can permanently damage the finish. Turn off the monitor and use a soft cloth and window cleaner to wipe the monitor screen of any dust or dirt that may have collected.

If liquid is spilled inside the keyboard, unplug the keyboard immediately, and turn upside down to allow the liquid to drain out. Let the keyboard dry overnight before attempting to use it again. If the keyboard is inoperable after this, contact Norland Products Technical Service.

Use a damp, lint free cloth to clean the outer skirt of the interferometer. If any dust or dirt has collected on the x, y, and z axis slides or the tilt stage and mounts, use compressed air to blow off particles. An alcohol wipe can be used on the tilt stage and mounts if excessively dirty.

NOTE: Do not attempt to clean the internal parts of the microscope unit. Use of a dust cover when the unit is not in use will prevent foreign particles from collecting on the equipment and will make maintenance of the system much easier.

Repacking Unit For Shipment

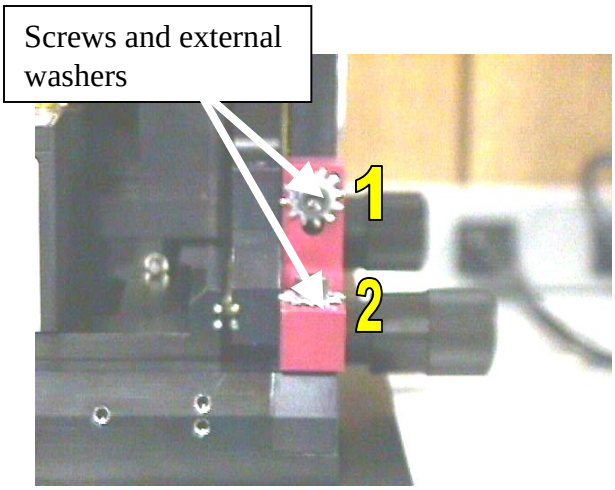
If the interferometer needs to be repacked for moving or shipping, it is very important that it is packed as it was received. Follow the Repacking Procedures on the next page.

NOTE: Norland Products strongly recommends that the NC/AC 3005, original, shipping containers be saved for future transportation needs. These containers may be purchased from Norland Products as P/N A-800100, Microscope Shipping Kit.

9.1 Repacking Procedures

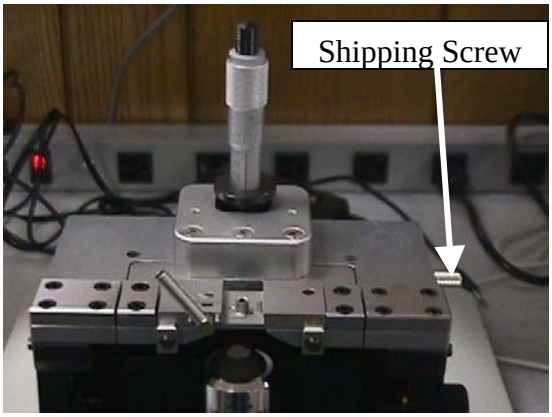
Step 1

- Place the shipping block on the right side of the interferometer with the two screws and external washers as shown. It may be necessary to adjust the X & Y knobs to line up the holes for the shipping block.
- Tighten screw 1 first, and then screw two. Not following this order may damage the X and Y axis.



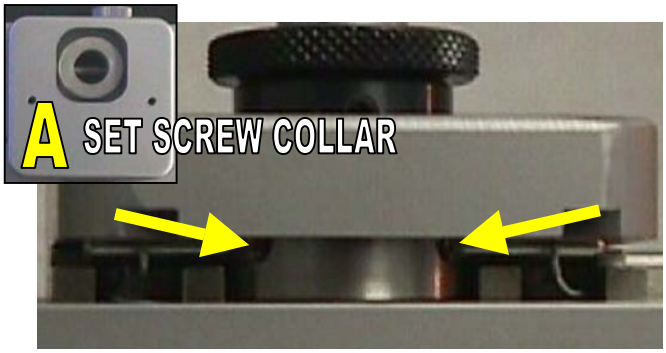
Step 2

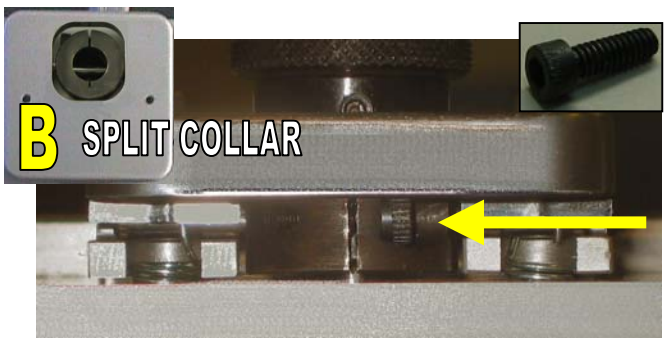
- Place the shipping screw into the right side of the Tilt Stage as shown and screw into place.



Step 3

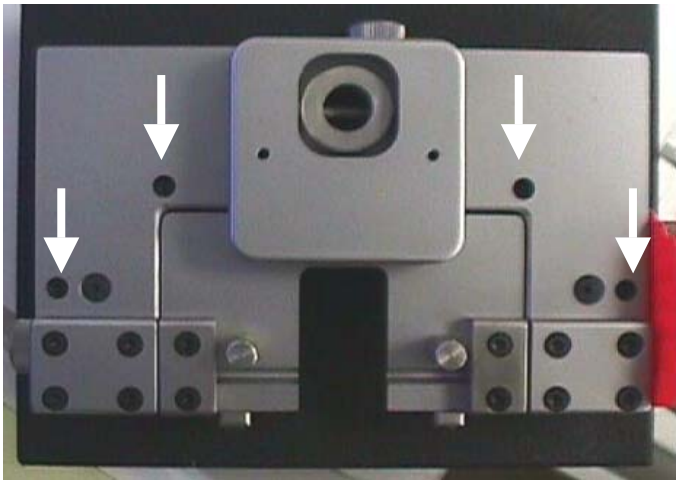
- Remove Micrometer:
  - For set screw collar:
    - Loosen the two set screws that hold the micrometer in place. The two screws are located towards the back of the tilt stage on the side of the round pivot collar, as indicated by the arrows in picture A.
  - For Split Collar
    - Loosen the cap head screw that holds the micrometer in place as shown in picture B.
- Remove the micrometer from the tilt stage and place into the accessories box.





Step 4

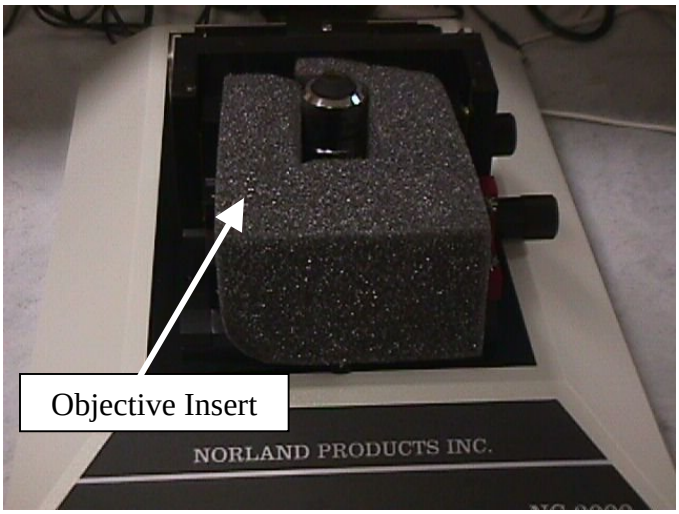
- Remove the Tilt Stage from the interferometer by removing the four screws and place the stage and screws into the accessories box.



Step 5

- Next place the Objective Insert over the lens, being very careful not to damage the mirrors.

- NOTE: NC 3000 objective shown.

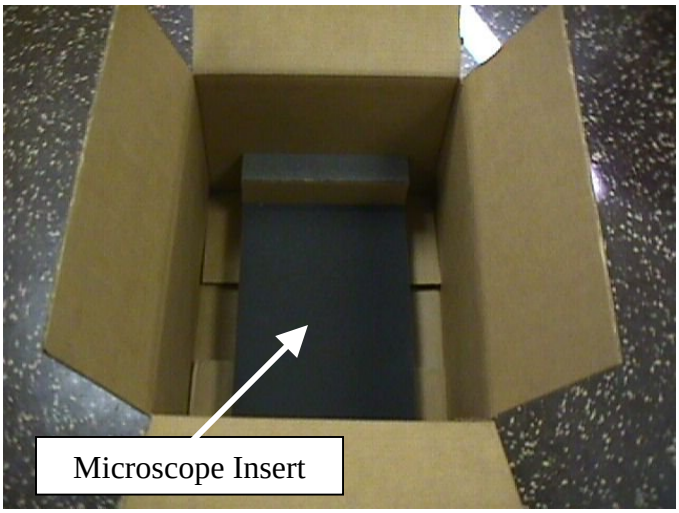


Step 6

- Place the interferometer into the plastic bag.

Step 7

- Prepare the shipping box and place the microscope insert into the box.

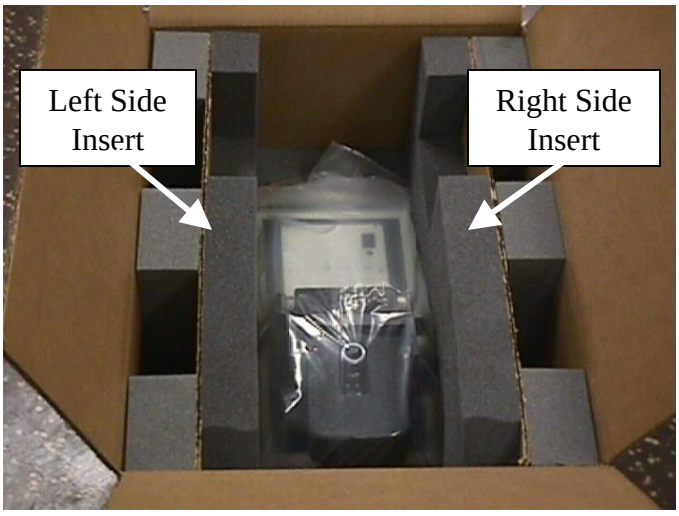


Step 8

- Place the interferometer into the shipping box.

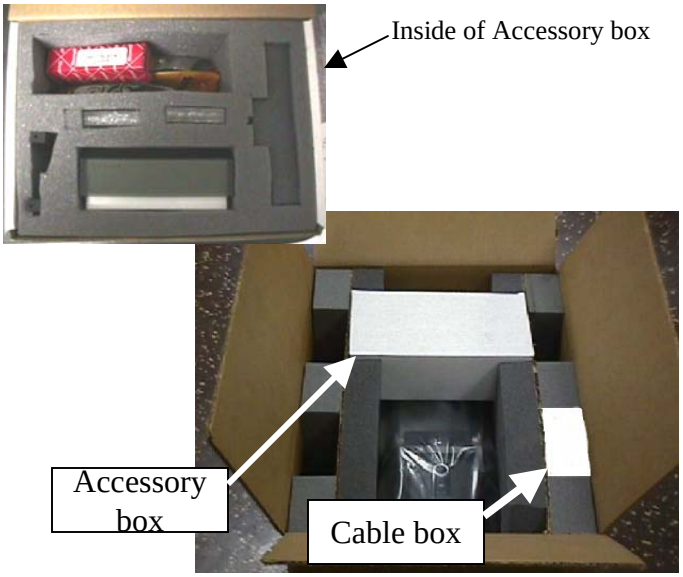
Step 9

- Place the right and left inserts into the shipping box.



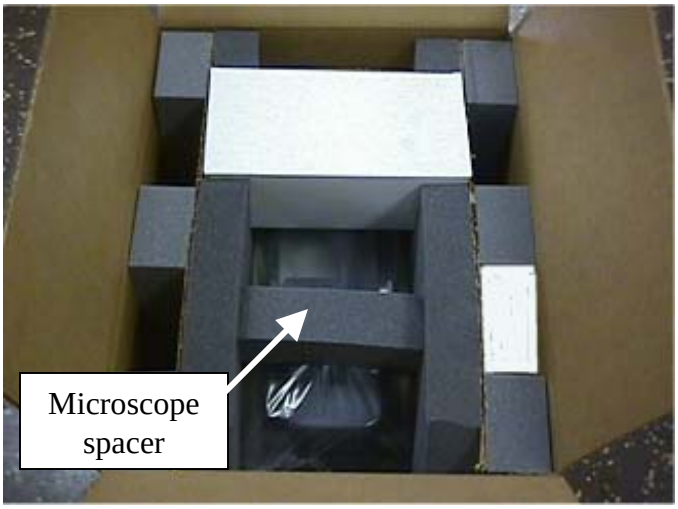
Step 10

- Make sure that the tilt stage, micrometer, and other accessories are placed securely into the accessory box.
- Place the accessory box into the shipping box.
- Place all microscope cables into cable box and insert it into the side of the box as shown in the picture.



Step 11

- Place the microscope spacer over the lens.



Step 12

- Close the box and seal it with strong shipping tape. **If the system arrived double boxed, please send back double boxed.**
- Send back to:

  Norland Products, Inc.
  2540 Rt. 130
  Suite 100
  Cranbury, NJ 08512

- Returns without a RMA number on the outside of the box will be refused. Please contact Norland Products for a RMA number.

APPENDIX

A. Magnification Calibration Procedures

Step 1

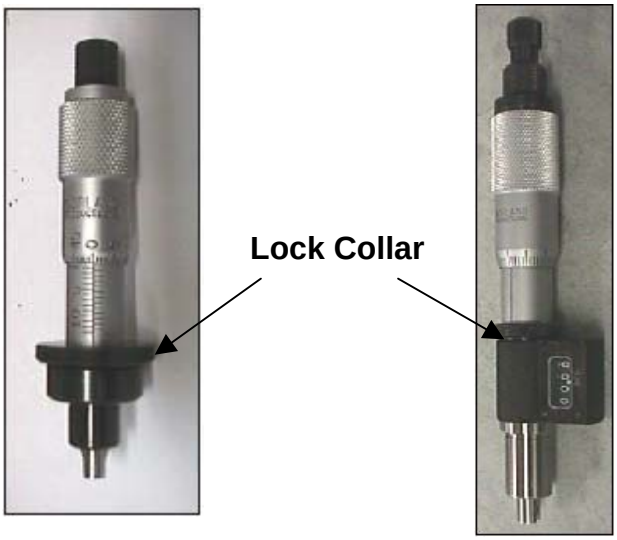
- Obtain the following:
  - Magnification Calibration Standard OR NIST Traceable Magnification Calibration Reticle (Optional)
  - Computer and Monitor powered up with ACCIS software running. The operator must be logged on as an ACCIS Administrator OR have the ability to load a previously created setup configuration that sets scan type to “Calibration”.
    - Refer to Security in the Configuring Data – Option Parameters Section
  - NC/AC 3005 microscope unit
  - Edge Alignment Mount (not needed if using NIST Traceable Magnification Calibration Reticle)
  - Alcohol & Lint free wipes or the supplied connector cleaner

Step 2

- If using the Optional NIST Traceable Reticle, proceed to step 15.
- If using the 12 fiber Magnification Standard, do the following:
  - Wipe all oils/dirt/dust off the surface of the tilt stage with alcohol. (Picture A)
  - Clean the bottom of the mount with alcohol. (Picture B)
  - Using compressed air, blow off any dust/particles that may be inside the mount. (Picture C)
  - Place the mount onto the stage and lock into place with the mount screws. (Picture D)

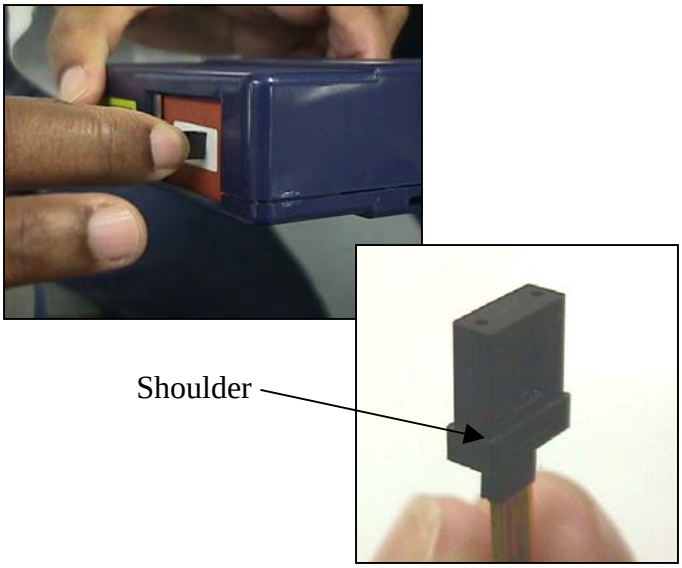
Step 3

- Verify that the lock collar is in the unlocked position by turning the lock collar counterclockwise.
- Set the micrometer to 0.0
  - Note: For the greatest accuracy and repeatability, final adjustments should always be done by turning the micrometer in a clockwise direction
- Turn the lock collar clockwise to lock into position.



Step 4

- Clean the MT 12 fiber Magnification Calibration Standard with the connector cleaner supplied.
  - Alcohol and a lint free wipe can be used instead of the connector cleaner if desired. Make sure any alcohol on the connector is wiped off before inserting the connector in the mount.
- Clean dirt/dust/oils off of the shoulder of the connector (the part that rests on the mount) so that it rests flush to the mount.

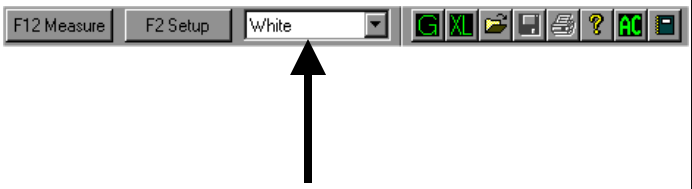


Step 5

- Insert the Magnification Calibration Standard into the mount with the epoxy well facing the back of the interferometer.
- Push the connector all the way down into the mount by applying equal pressure on the left and right side of the connector.
  - If there is play between the mount and the connector, adjust the screw on the mount so the connector is held snuggly in place.
    - Mount should not be too tight as this may damage the connector when inserting/removing it.

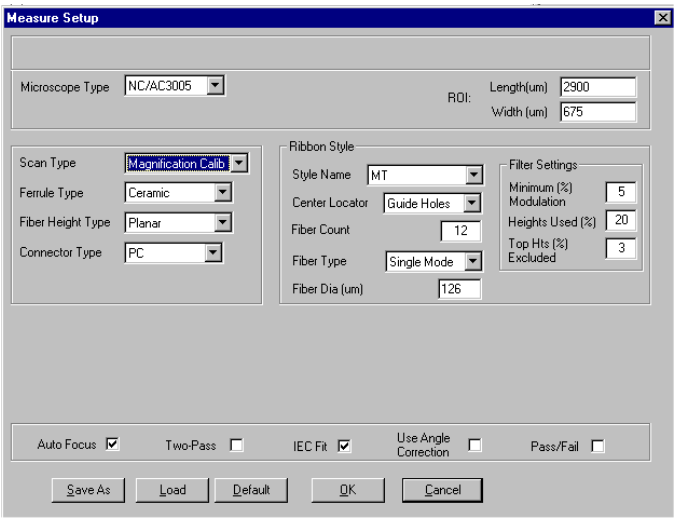
Step 6

- Change to White Light mode if not already in it.



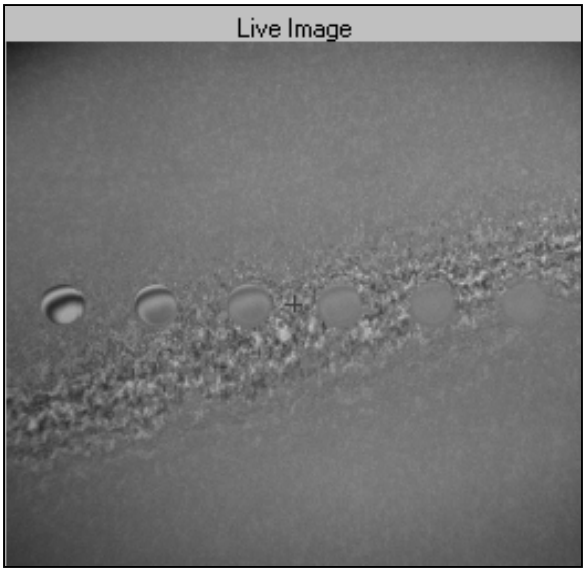
Step 7

- Go into the Set-Up screen by pressing the "F2 Setup" button on the Toolbar.
- Click "Default"
- Select Microscope Type: NC/AC 3005
- Change Scan Type to "Magnification Calibration"
  - This will automatically change Center Locator to "Guide Holes"
- Click "OK" to save the parameters and exit the set up screen



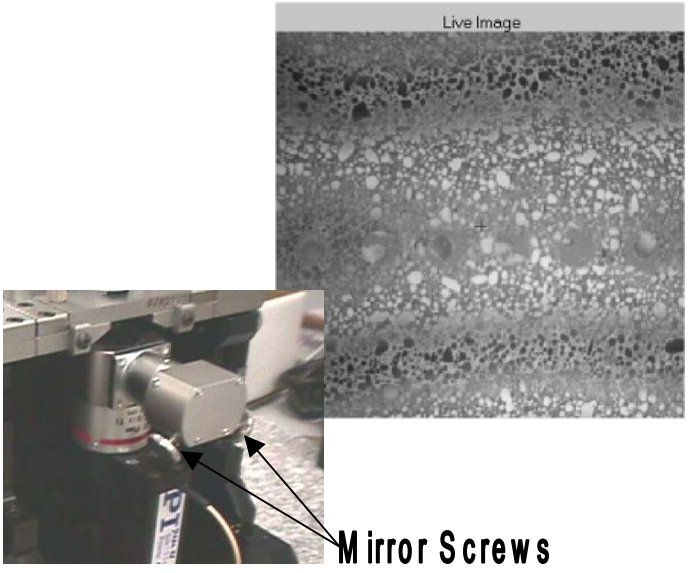
Step 8

- Adjust the focus knob to bring the fringe pattern into the middle of the live image screen.



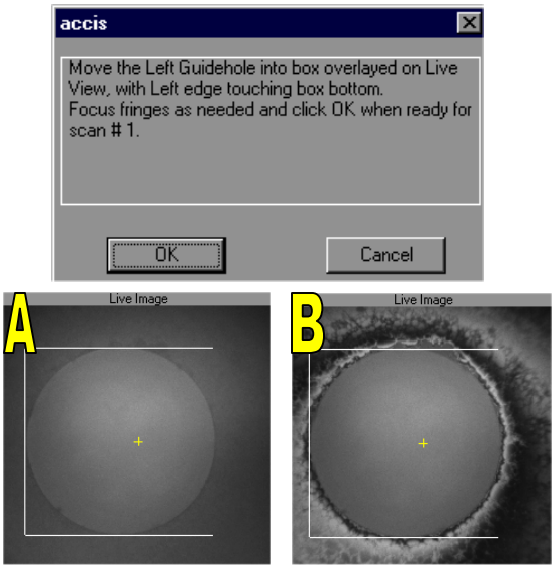
Step 9

- Adjust the mirror knobs one at a time to expand the fringe pattern over the surface of the connector so that it seems to bubble out from the center of the connector or vice versa when adjusting the focus knob. Refer to Step 9 in the One Pass measurement process.
  - NOTE: The mirror is VERY sensitive to even the slightest movement of the mirror knobs, so be very gentle when turning them.



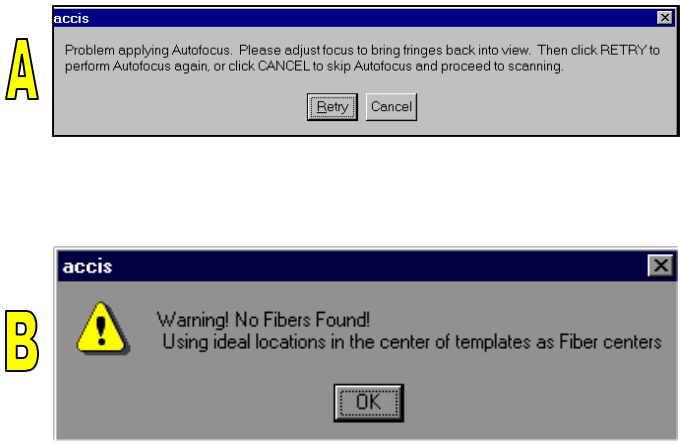
Step 10

- Press “F12 Measure” on the Toolbar or F12 on the keyboard.
- Follow the command prompt.
  - Adjust the focus knob to move the fringe pattern out of the view - Picture A.
  - Place the guide hole into the box so the left edge is touching the box bottom (I.e. The left vertical line.) and is centered vertically in the template - picture A.
  - Adjust the focus knob to bring the fringe pattern into the center of the live image screen - Picture B.
  - Press OK
- Make sure not to cause any vibrations.
- If desired, the Connector ID can be changed while the scan is in progress. Click on OK after the Connector ID has been changed.


accis
Move the Left Guidehole into box overlayed on Live View, with Left edge touching box bottom.
Focus fringes as needed and click OK when ready for scan # 1.
OK
Cancel
A
Live Image
B
Live Image

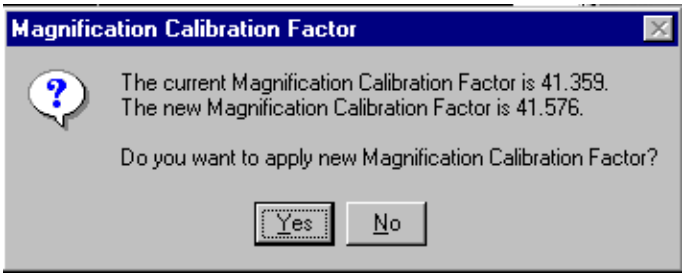
Step 11

- The interferometer will go through a few scans to measure and map the surface of the connector.
  - Occasionally, the Auto Focus may fail. If it does, adjust the focus knob to bring the fringe pattern into view and click RETRY. If it fails again, click on CANCEL to allow the interferometer to scan the entire region.
- A prompt may appear (Picture B) informing you that no fibers were found (this is due to the flat and mirror like polish on the connector endface). Press OK.


A
accis
Problem applying Autofocus. Please adjust focus to bring fringes back into view. Then click RETRY to perform Autofocus again, or click CANCEL to skip Autofocus and proceed to scanning.
Retry
Cancel
B
accis
Warning! No Fibers Found!
Using ideal locations in the center of templates as Fiber centers
OK

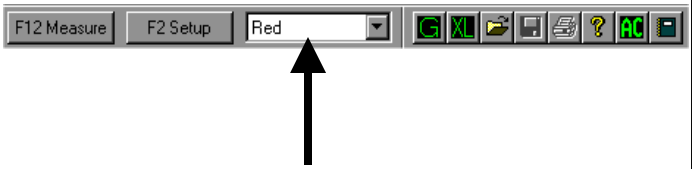
Step 12

- Upon completion of the scan, a prompt will appear that displays the suggested Magnification Calibration Factor value.
  - If the new value differs from the value in the field by more than 0.2 (as shown in the picture to the right), click “Yes” to change to the new Magnification Calibration factor.
  - If it differs by less than 0.2, click “No” in the prompt.


Magnification Calibration Factor
The current Magnification Calibration Factor is 41.359.
The new Magnification Calibration Factor is 41.576.
Do you want to apply new Magnification Calibration Factor?
Yes
No

Step 13

- Change to Red light Mode.



Step 14

- Repeat Steps 7-12 to do the Magnification Calibration for the Red light mode.

Upon completion of the Magnification Calibration, proceed to any of the following:

• 0-8º Calibration Standard procedures (if ordered) in order to verify the accuracy of the micrometer.

OR

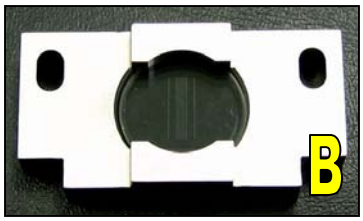
•End face Angle Calibration procedures to determine the Angle Correction factors to calibrate the mount being used during analysis (if using a Pin Alignment mount and performing One Pass w/ Use Angle Correction" selected).

OR

•MEASURING a CONNECTOR section.

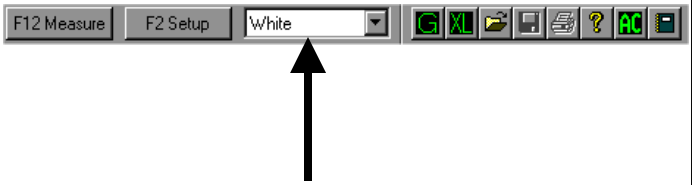
Step 15 - NIST Traceable Reticle

- Wipe all oils/dirt/dust off the surface of the tilt stage with alcohol. (Picture A)
- Clean the bottom of the mount and reticle with alcohol. (Picture B)
- Use compressed air to remove and dirt/dust on the glass. Make sure not to damage the lines on the reticle as that will affect the data.
- Place the reticle mount onto the stage and lock into place with the mount screws. (Picture C)



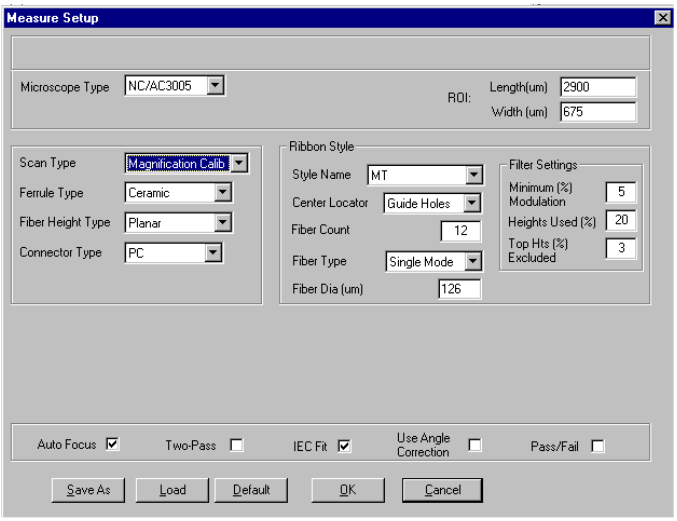
Step 16

- Change to White Light mode if not already in it.



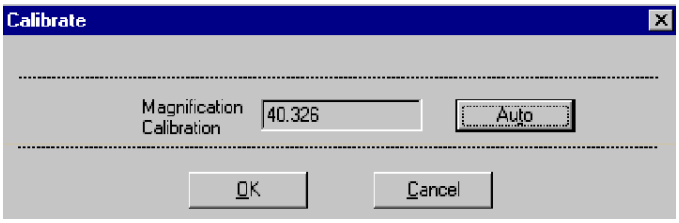
Step 17

- Go into the Set-Up screen by pressing the "F2 Setup" button on the Toolbar.
- Click "Default"
- Select Microscope Type: NC/AC 3005
- Change Scan Type to "Magnification Calibration"
  - This will automatically change Center Locator to "Guide Holes"
- Click "OK" to save the parameters and exit the set up screen



Step 18

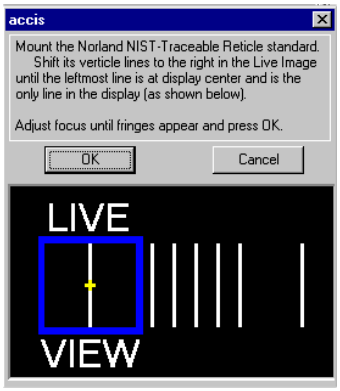
- Go into Action on the Menu bar and select Calibrate screen as shown in the picture.
- Click on "Auto"

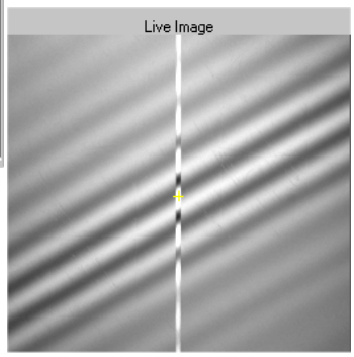


Step 19

- Follow the command prompt:
  - Adjust the X axis until the leftmost line in the live image view is centered on the yellow crosshair.
  - Adjust the focus knob to bring the fringe pattern in view.
  - Press “OK”

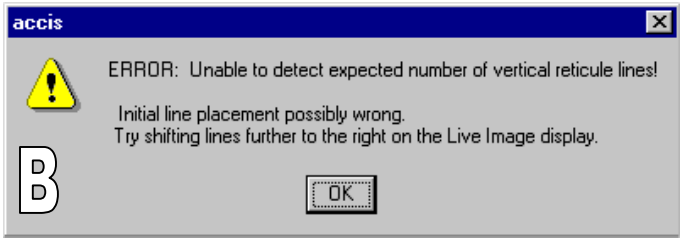
NOTE: The directions in the command prompt are dependent upon the Microscope Type selected in the Set-Up menu. Placement of the line is different when Advantage is selected.


accis
Mount the Norland NIST-Traceable Reticle standard.
Shift its verticle lines to the right in the Live Image until the leftmost line is at display center and is the only line in the display (as shown below).
Adjust focus until fringes appear and press OK.
OK
Cancel
LIVE
VIEW



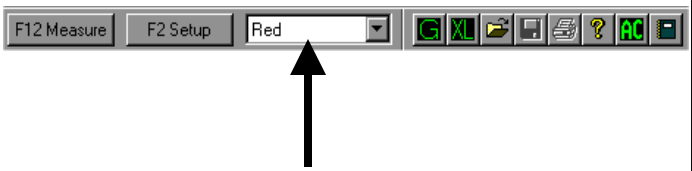
Step 20

- The computer will go through a few scans and determine the magnification calibration. The magnification calibration will be updated automatically if any changes are needed, as shown in picture A.
  - If the wrong line was placed in the live image, an error message (shown in picture B) will appear.
- Press “OK” to save and exit data.


accis
ERROR: Unable to detect expected number of vertical reticule lines!
Initial line placement possibly wrong.
Try shifting lines further to the right on the Live Image display.
OK
B

Step 21

Change to Red light Mode.



Step 22 • Repeat Steps 17-20 to do the Magnification Calibration Factor for the Red light mode.	Upon completion of the Magnification Calibration, proceed to any of the following: • 0-8º Calibration Standard procedures (if ordered) in order to verify the accuracy of the micrometer. OR •End face Angle Calibration procedures to determine the Angle Correction factors to calibrate the mount being used during analysis (if using a Pin Alignment mount and performing One Pass w/ Use Angle Correction" selected). OR •MEASURING a CONNECTOR section.

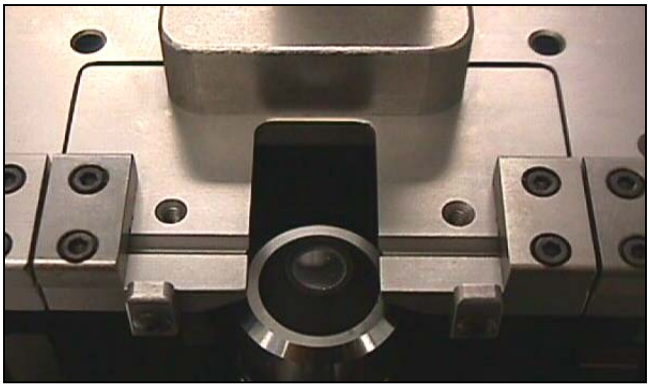
B. 8º Calibration Standard Procedures

Step 1

- The following is needed before starting this procedure:
  - 8º calibration standard (optional) with mount screws.
  - Computer and Monitor powered up with ACCIS software running.
  - NC/AC 3005 microscope unit with a tilt stage and micrometer.
  - Alcohol
  - Lens cleaning tissue

Step 2

- Remove the mount on the tilt stage if there is one.
- In order to assure that the 8º standard will lie flush to the tilt stage, all oils/dirt/dust must be wiped off the surface of the tilt stage with alcohol.

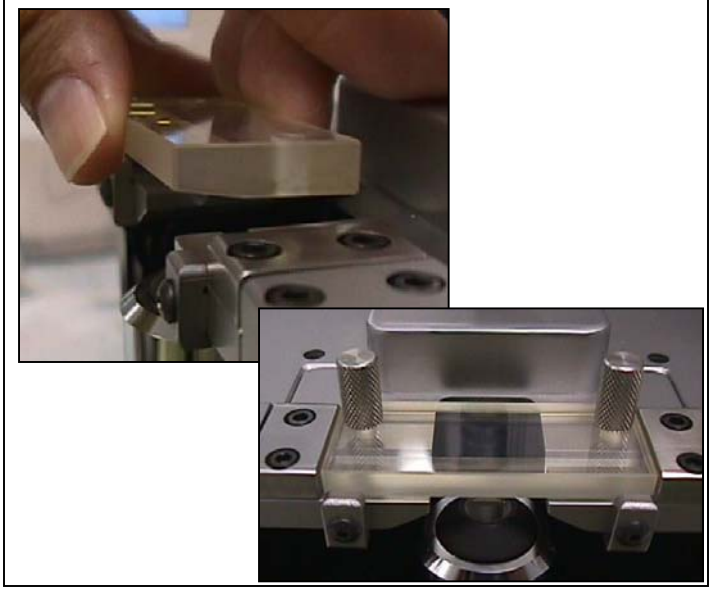


Step 3

- Acquire the 8º standard from its packaging. Only handle the edges of the standard.
  - The 8º standard must be handled **very carefully.** Never place the standard on top of rough surfaces and always place the standard back into its original packaging wrapped carefully in the lens cleaning tissue. Do not drop the standard on the floor or on the table.
- If there is any oils/dirt/dust on the surface of the 8º standard, wipe it off with alcohol and lens cleaning tissue.
  - Do not use rough material to clean the standard.

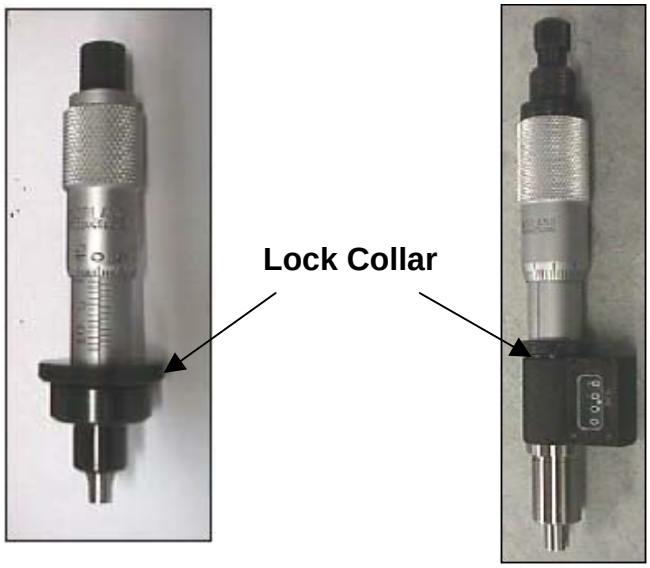
Step 4

- Place the 8º standard on the tilt stage as shown and attach to the tilt stage using the mount screws. Screw on finger tight.



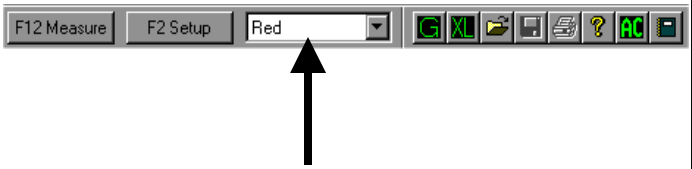
Step 5

- Verify that the lock collar is in the unlocked position by turning the lock collar counterclockwise.
- Set the micrometer to 0.0
  - Note: For the greatest accuracy and repeatability, final adjustments should always be done by turning the micrometer in a clockwise direction
- Turn the lock collar clockwise to lock into position.



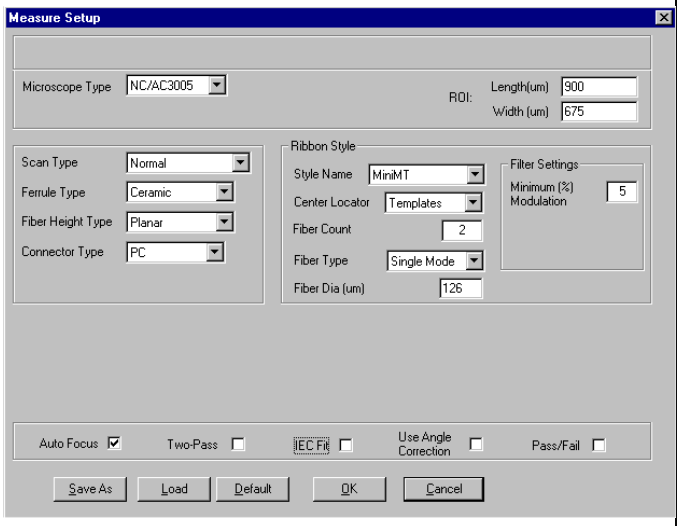
Step 6

- Change to Red Mode.



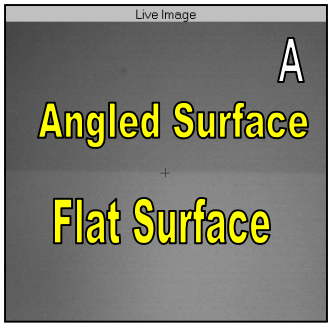
Step 7

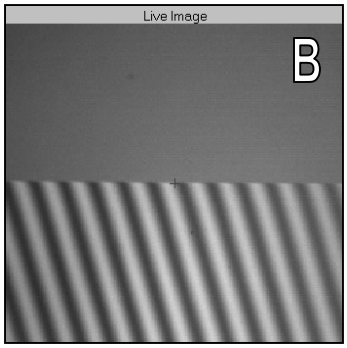
- Click “F2 Set Up” on the Tool Bar to modify the set up parameters.
- Click “Default” at the bottom of the dialog box.
- Select Microscope Type: NC/AC 3005
- Change Style Name to “MiniMT”
- Deselect IEC fit.
- Click OK to save and exit the set up screen.



Step 8

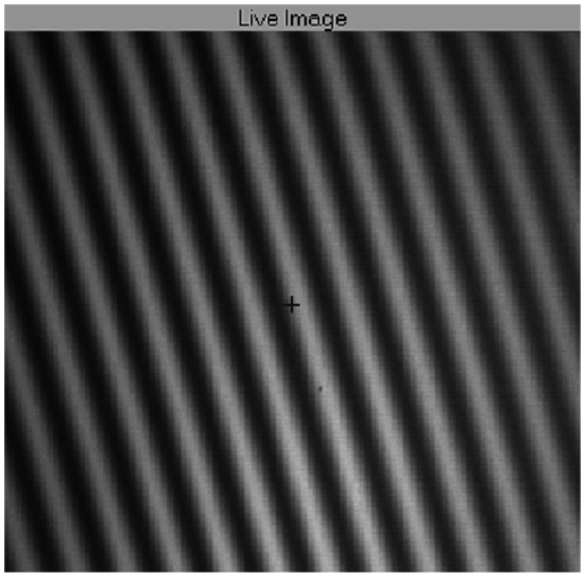
- Turn the y-axis until the intersection of the flat surface and the angled surface can be seen clearly on the screen approximately in the middle. (Picture A)
- Turn the focus knob until a fringe pattern can be seen on the flat surface (the bottom portion of the live image screen). (Picture B)





Step 9

- Turn the y-axis knob clockwise to bring the fringe pattern on the flat surface into full view in the image screen.
- Adjust focus knob if needed to obtain fringe pattern.

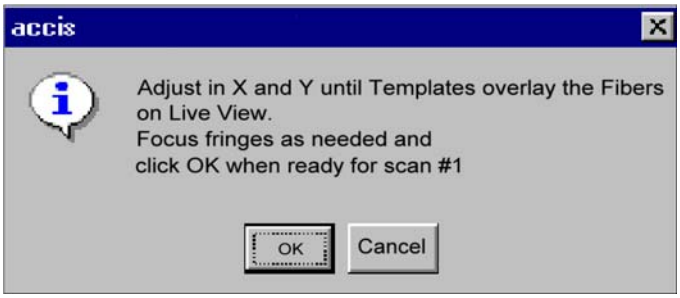


Step 10

- Adjust mirror knobs one at a time to expand the fringe pattern until 1 horizontal fringe can be obtained, i.e. an entire white fringe or black fringe takes up the live image screen.
- NOTE: The mirror is VERY sensitive to even the slightest movement of the mirror knobs, so be very gentle when turning them.

Step 11

- Press “F12 Measure” on the Tool Bar.
  - Press OK to bypass the prompt that asks you to line up the fibers.
- If desired, the Connector ID can be changed while the scan is in progress.
  - Click on OK after the Connector ID has been changed.
  - Make sure not to cause any vibrations.


accis
Adjust in X and Y until Templates overlay the Fibers on Live View.
Focus fringes as needed and
click OK when ready for scan #1
OK
Cancel

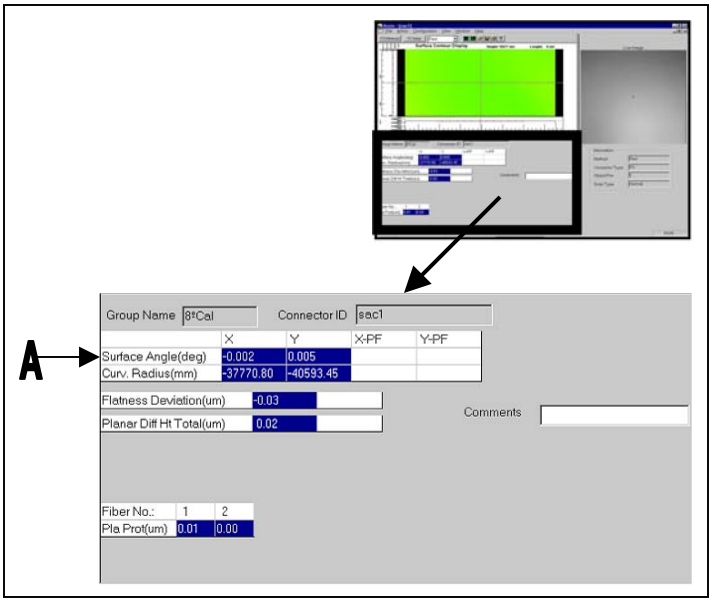
Step 12

- The interferometer will go through a few scans to measure and map the surface of the calibration standard.
- Occasionally, the Auto Focus may fail. If it does, adjust the focus knob to bring the fringe pattern into view and click RETRY. If it fails again, click on CANCEL to allow the interferometer to scan the entire region.

accis
Problem applying Autofocus. Please adjust focus to bring fringes back into view. Then click RETRY to perform Autofocus again, or click CANCEL to skip Autofocus and proceed to scanning.
Retry
Cancel

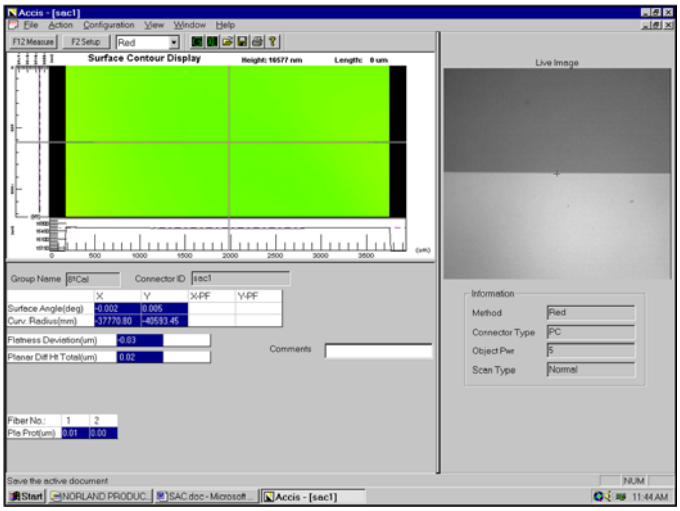
Step 13

- When the scans are completed, note the readings obtained for the End face Angle in the X and Y direction (shown by arrow A). The goal is to have measurement readings of 0 ± 0.02º for both the X and Y.
  - If not, repeat steps 10-13 until both measurement readings are 0 ± 0.02º.
  - If they are 0 ± 0.02º, then the flat surface of the 8º standard is perpendicular to the optical path. Move on to step 14.



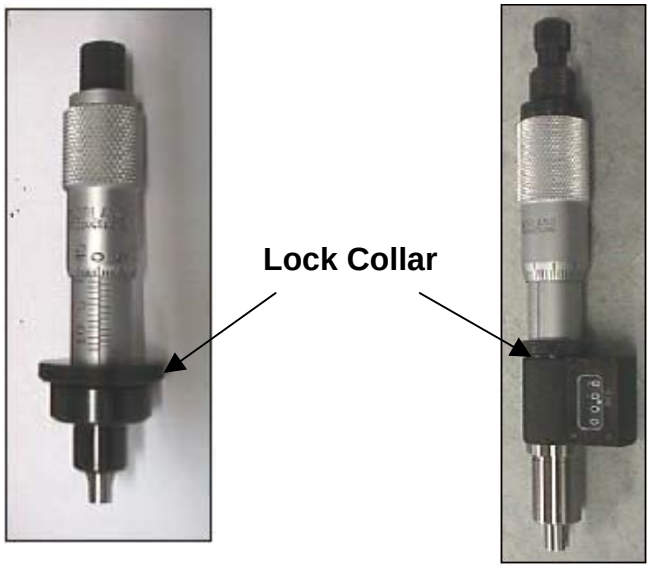
Step 14

- Turn the y-axis knob counterclockwise to bring the intersection of the two surfaces back to the middle of the screen.
- During the rest of the 0-8º calibration procedure, NEVER ADJUST ANY OF THE THUMB SCREWS OR MIRROR KNOBS AFTER THE CALIBRATION STANDARD HAS BEEN LEVELED.



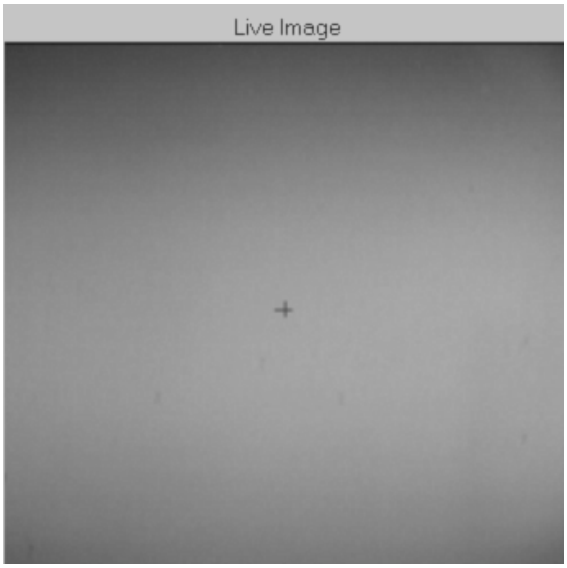
Step 15

- Verify the lock collar on the micrometer is in the unlocked position by turning the lock collar counterclockwise.
- Turn the micrometer clockwise to 8º
- Lock the micrometer into position by turning the lock collar in the clockwise direction.



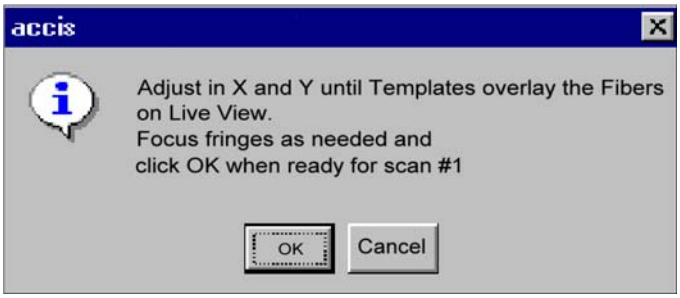
Step 16

- Turn the y-axis knob counterclockwise to bring the fringe pattern on the angled surface into full view in the image screen.
- Adjust the focus knob until the maximum fringe pattern is obtained.



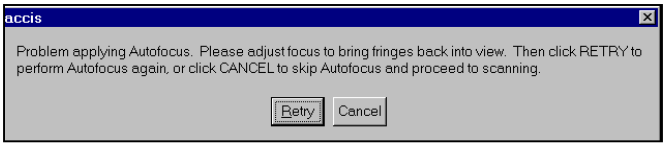
Step 17

- Press “F12 Measure” on the Tool Bar.
  - Press OK to bypass the prompt that asks you to line up the fibers.
- If desired, the Connector ID can be changed while the scan is in progress.
  - Click on OK after the Connector ID has been changed.
  - Make sure not to cause any vibrations.


accis
Adjust in X and Y until Templates overlay the Fibers on Live View.
Focus fringes as needed and
click OK when ready for scan #1
OK
Cancel

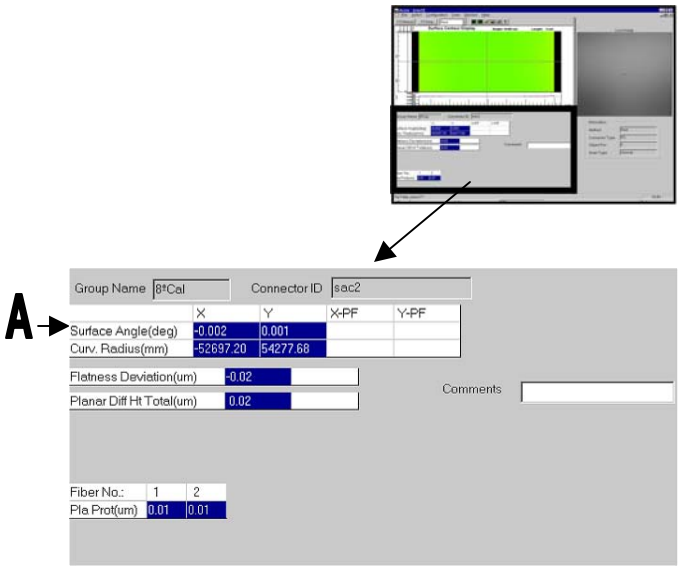
Step 18

- The interferometer will go through a few scans to measure and map the surface of the connector.
- Occasionally, the Auto Focus may fail. If it does, adjust the focus knob to bring the fringe pattern into view and click RETRY. If it fails again, click on CANCEL to allow the interferometer to scan the entire region.


accis
Problem applying Autofocus. Please adjust focus to bring fringes back into view. Then click RETRY to perform Autofocus again, or click CANCEL to skip Autofocus and proceed to scanning.
Retry
Cancel

Step 19

- When the scans are completed, note the readings obtained for the End face Angle in the X and Y direction (shown by arrow A). The goal is to have measurement readings of 0 ± 0.02º for both the X and Y.
  - If they are, then the flat surface of the 8º standard is perpendicular to the optical path. Move on to step 21.
  - If they are not and the angle is more than 0 ± 0.02º, proceed to Step 20.



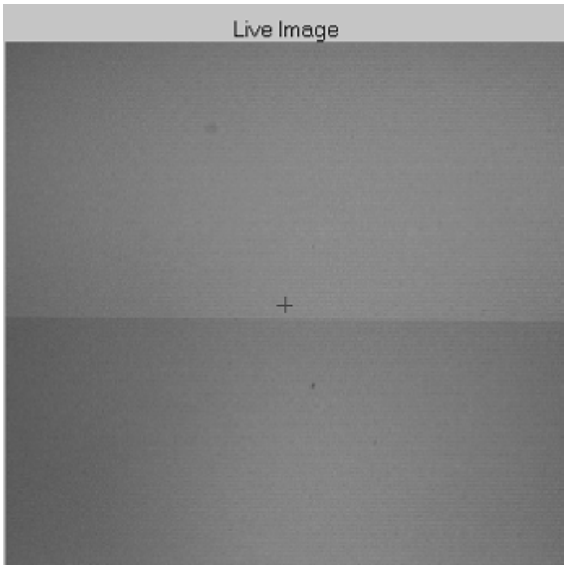
Step 20

- If there is an x or y error larger than 0 ± 0.02º for both the X and Y, then check the following:
  - The micrometer may be incorrectly installed and must be removed and re-installed and re-leveled. And the entire 8º standard procedure must be repeated.
  - If the above does not work, please contact Norland Products Inc.

Please refer to the Tilt Stage & Micrometer Installation Procedures

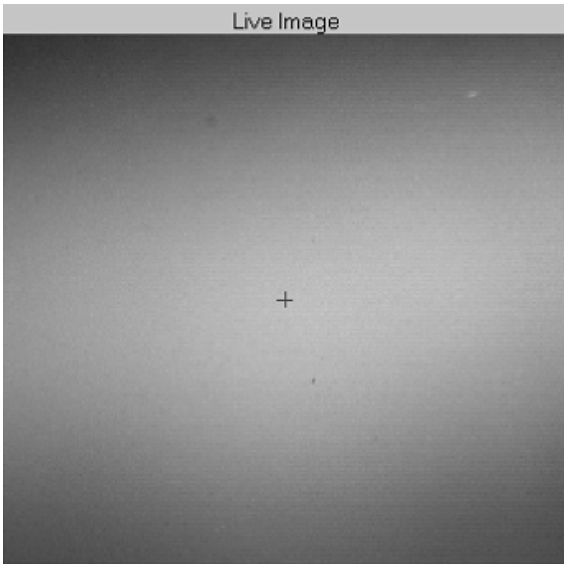
Step 21

- Turn the y-axis knob clockwise to bring the intersection of the two surfaces back to the middle of the screen.



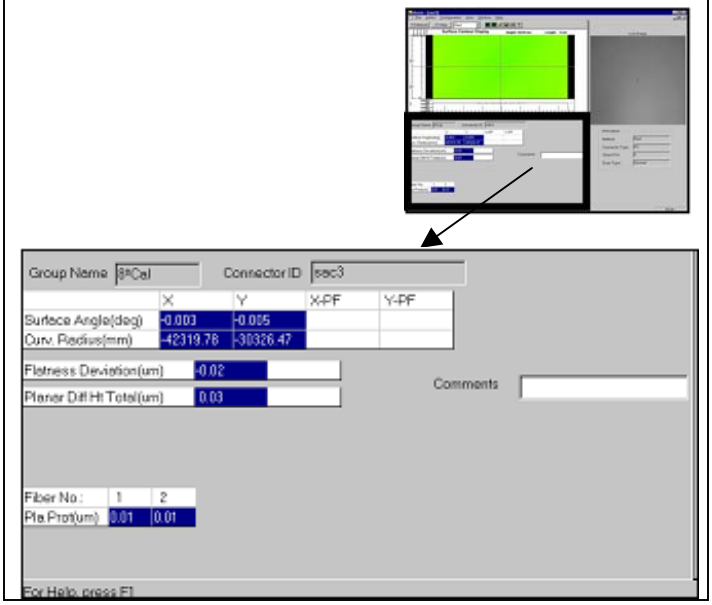
Step 22

- Unlock the lock collar by turning it in a counterclockwise direction.
- Turn the micrometer counterclockwise back to 0.0
  - Note: For the greatest accuracy and repeatability, final adjustments should always be done by turning the micrometer in a clockwise direction
- Turn the lock collar clockwise to lock into position.
- Adjust focus to obtain the maximum fringe pattern.
- Turn y knob clockwise to bring the fringe pattern on the flat surface into full view in the image screen.



Step 23

- Press “F2 Measure” on the Tool Bar to take a measurement.
  - If End face Angle measurements are similar to the beginning, the 8º tilt using the micrometer is accurate.
  - If the End face Angle measurements are off only slightly, dust may have collected underneath the lever arm that the micrometer is in.
    - Lift the lever arm slightly and blow any dust away with compressed air and take another measurement.



- If End face Angle measurements are not even similar to the measurement readings from the beginning and attempts to clean underneath the lever arm are unsuccessful, please contact Norland Products.

Upon completion of the 0-8º Calibration procedures, proceed to any of the following:

•End face Angle Calibration procedures to determine the Angle Correction factors to calibrate the mount being used during analysis (if using a Pin Alignment mount and performing One Pass w/ Use Angle Correction” selected).

OR

•MEASURING a CONNECTOR section of this manual if using an EDGE Alignment mount and performing One Pass measurements.

C. End face Angle Calibration Procedures

Step 1

- Obtain the following:
  - Relatively flat connector (that the Pin Alignment mount is designed for)
  - Computer and Monitor powered up with ACCIS software running. The operator must be logged on as an ACCIS Administrator.
  - NC/AC 3005 microscope unit
  - Pin Alignment Mount
  - Alcohol & Lint free wipes or the supplied connector cleaner

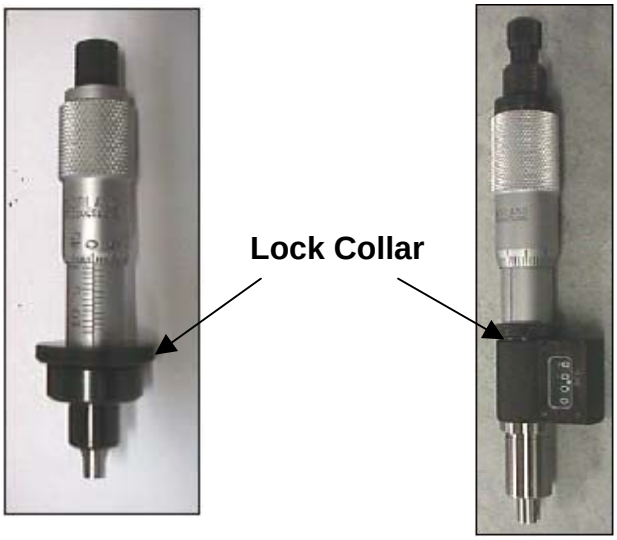
NOTE: The pictures in this procedure show a 12 fiber MT connector.

Step 2

- Wipe all oils/dirt/dust off the surface of the tilt stage with alcohol.
- Clean the bottom of the mount with alcohol.
- Using compressed air, blow off any dust/particles that may be inside the mount.
- Place the mount onto the stage and lock into place with the mount screws.

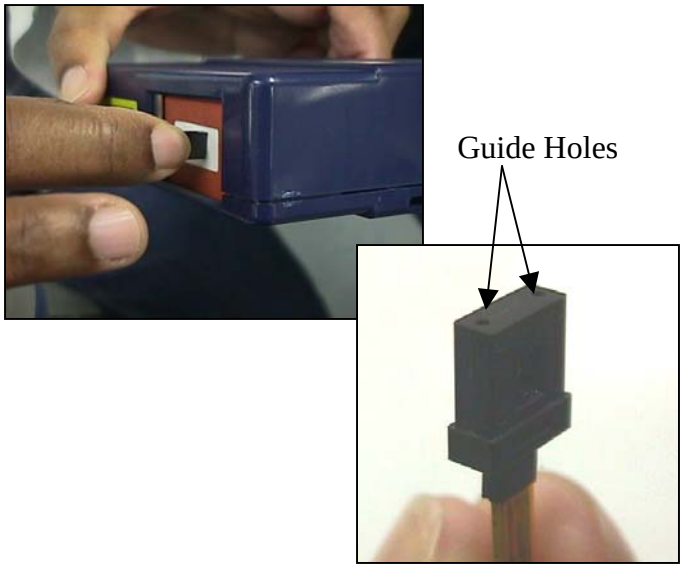
Step 3

- Verify that the lock collar is in the unlocked position by turning the lock collar counterclockwise.
- Set the micrometer to 0.0



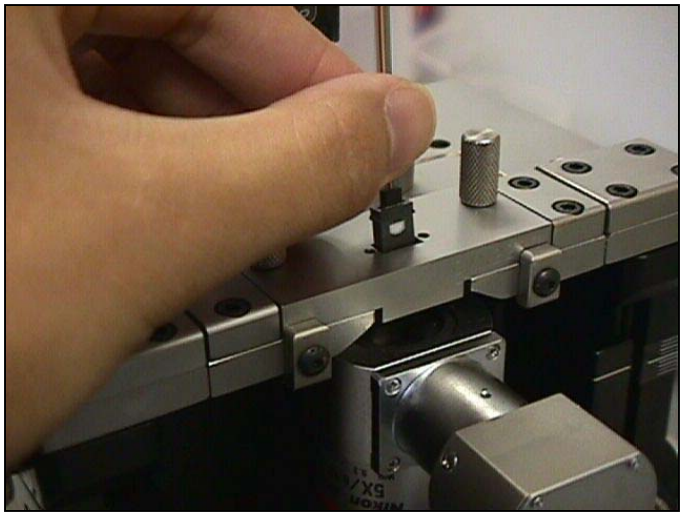
Step 4

- Clean the connector with the connector cleaner supplied.
  - Alcohol and a lint free wipe can be used instead of the connector cleaner if desired. Make sure any alcohol on the connector is wiped off before inserting the connector in the mount.
- Make sure the guide holes are clean.



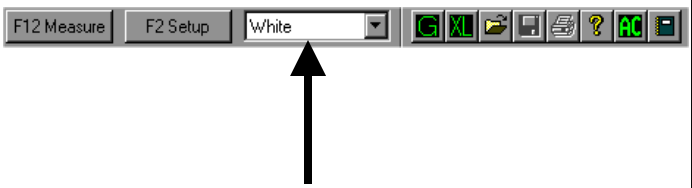
Step 5

- Insert the connector into the mount with the epoxy well facing the front of the interferometer.
  - Make sure the guide holes are correctly placed on the guide pins. If inserted incorrectly, the guide pins in the mount may be destroyed.
- Push the connector all the way down into the mount by applying equal pressure on the left and right side of the connector.



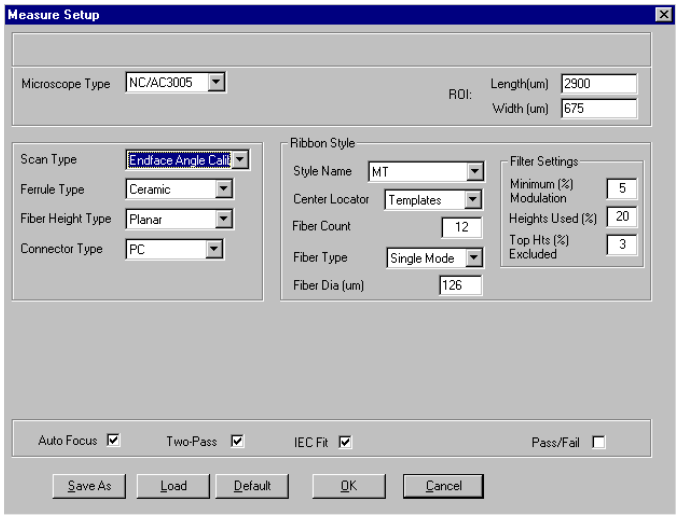
Step 6

- Change to WHITE light mode if not already in it.



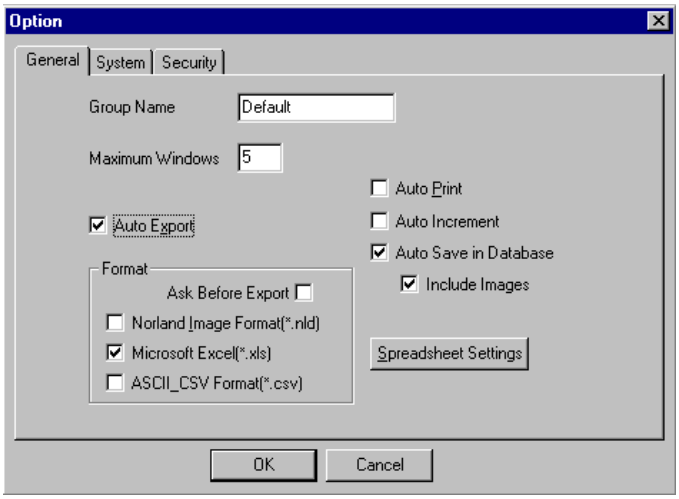
Step 7

- Go into the Set-Up screen by pressing the "F2 Setup" button on the Toolbar.
- Click "Default"
- Select Microscope Type: NC/AC 3005
- Change Scan Type to "End face Angle Calibration"
  - This will automatically change to Two Pass mode.
- Change Style Name to the connector being measured, ie MiniMt or MT
- Click "OK" to save the parameters and exit the set up screen.



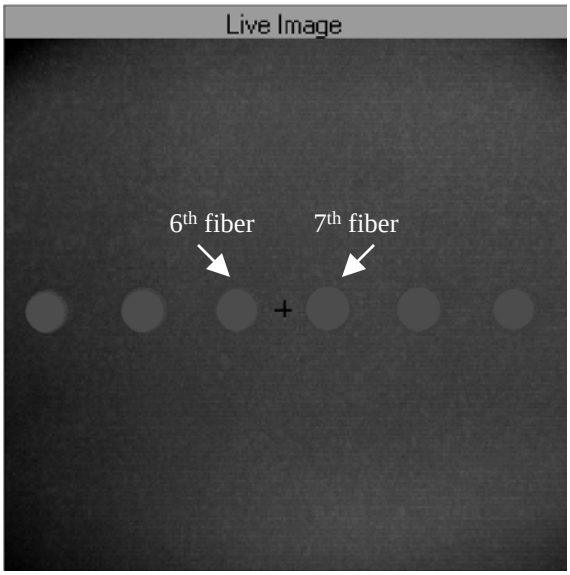
Step 8

- Go into the Configuration → Option screen.
- Click on the General Tab
  - Enter Group Name and select auto save and auto increment if desired.
- Click OK to exit screen and return to the program.



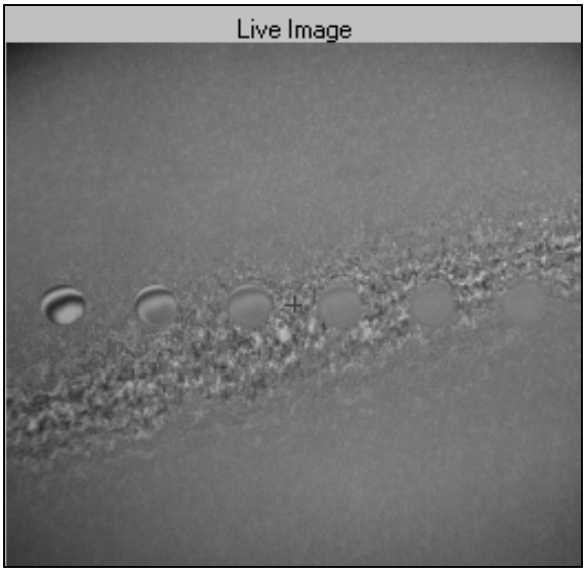
Step 9

- Adjust the X and Y knobs until the crosshairs lie between the 6th and 7th fibers (the middle of the connector) in the Live Image Screen.
- If it is difficult to see the fibers, the live image can be enlarged by double clicking on the live image. Scans can be taken with the live image enlarged.



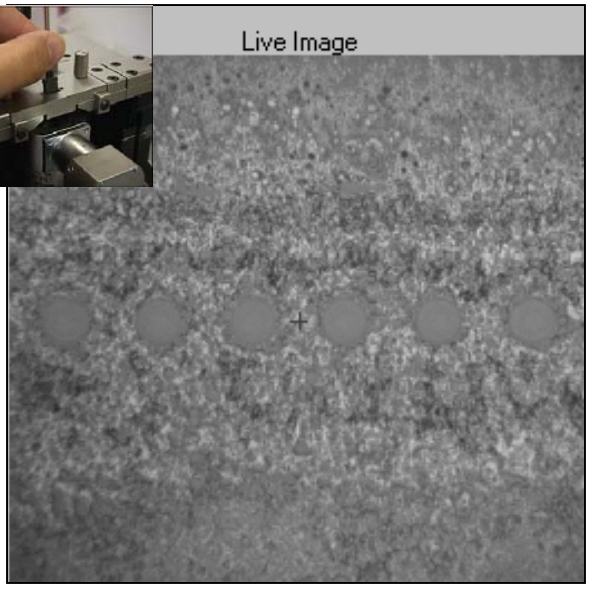
Step 10

- Adjust the z focus knob slowly until a fringe pattern can be seen over the fibers in the center of the Live Image View.
  - The fringe pattern can be in any direction/orientation on the screen
- Note approximately how much of the live image the fringe pattern takes up.
  - For example, the fringe pattern takes up approximately 10 % of the image screen.



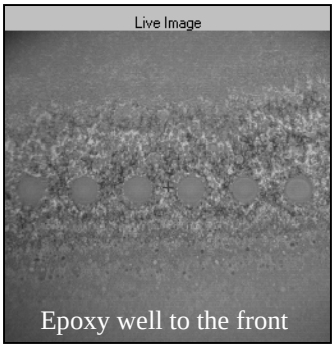
Step 11

- Rotate the connector 180º so that the epoxy well is facing the back of the interferometer.
- Adjust the Z focus knob to bring the fringe pattern to the center of view in the Live Image Screen.
  - The fringe pattern can be in any direction/orientation on the screen.
- Note approximately how much of the live image the fringe pattern takes up.
  - For example, the fringe pattern takes up approximately the entire screen.



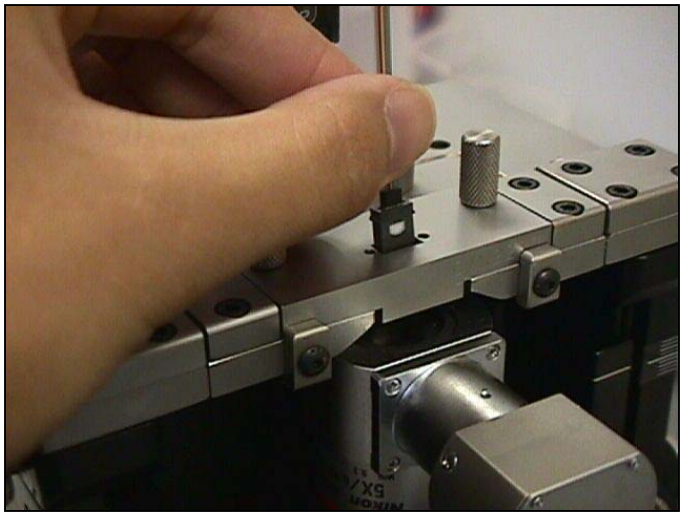
Step 12

- Turn the connector to the orientation that has the smaller fringe pattern. (In this case, the epoxy well to the front.)
  - Adjust the mirror to expand the fringe pattern to take up an average % of the areas from steps 10 and 11.
    - NOTE: The mirror is VERY sensitive to even the slightest movement of the mirror screws, so be very gentle when turning them.
  - Rotate the connector 180º to check the fringe pattern in the other direction. (The fringe pattern can be in any direction/orientation on the screen.)
- Rotating the connector and adjusting the mirror may have to be done a few times until the fringe pattern is equal in both the front and back orientations.
  - DO NOT TOUCH THE MIRROR KNOBS AFTER ADJUSTMENTS HAVE BEEN MADE!



Step 13

- Rotate the connector so that the epoxy well is facing the front of the interferometer.



Step 14

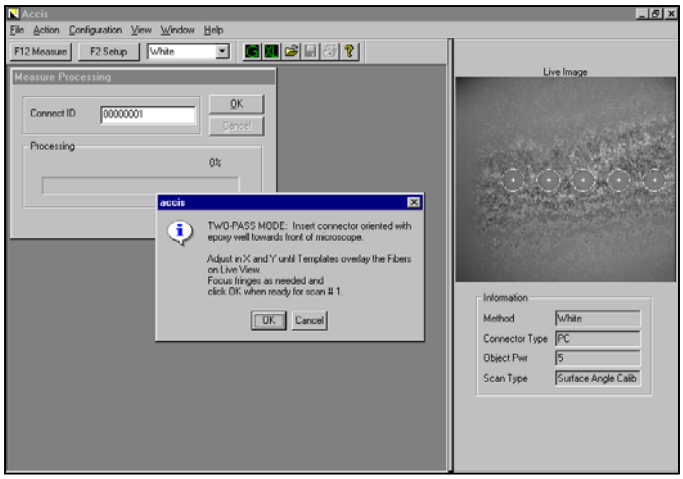
•Press “F12 Measure” on the Toolbar or F12 on the keyboard.

•Follow the command prompt.

- •Adjust the focus knob to move the fringe pattern out of the view.
- •Adjust the X & Y knobs to place the fibers in the center of the templates.
  - •Make sure the leftmost fiber is located in the leftmost template.
  - •NOTE: If it is difficult to center the fibers into the templates, the live image can be enlarged by double clicking on the live image. Scans can be taken with the live image enlarged.
- •Adjust the focus knob to bring the fringe pattern into the center of the live image screen
- •Press OK

•If desired, the Connector ID can be changed while the scan is in progress. Click on OK after the Connector ID has been changed.

- •Make sure not to cause any vibrations.



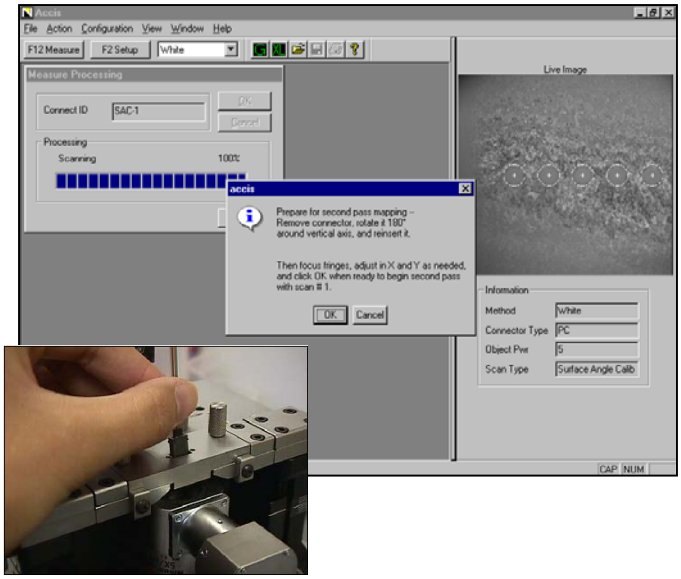
Step 15

- The interferometer will go through a few scans to measure and map the surface of the connector.
- Occasionally, the Auto Focus may fail. If it does, adjust the focus knob to bring the fringe pattern into view and click RETRY. If it fails again, click on CANCEL to allow the interferometer to scan the entire region.

accis
Problem applying Autofocus. Please adjust focus to bring fringes back into view. Then click RETRY to perform Autofocus again, or click CANCEL to skip Autofocus and proceed to scanning.
Retry
Cancel

Step 16

- When the scan is completed, follow the command prompt that appears.
  - Rotate the connector 180º so the epoxy well is facing the back of the interferometer.
  - Adjust the focus knob to bring the fringe pattern out of view.
  - Adjust the X & Y knobs to put the fibers into the center of the templates.
  - Adjust the focus knob to bring the fringe pattern into the center of the live image screen.
  - Press OK



Step 17

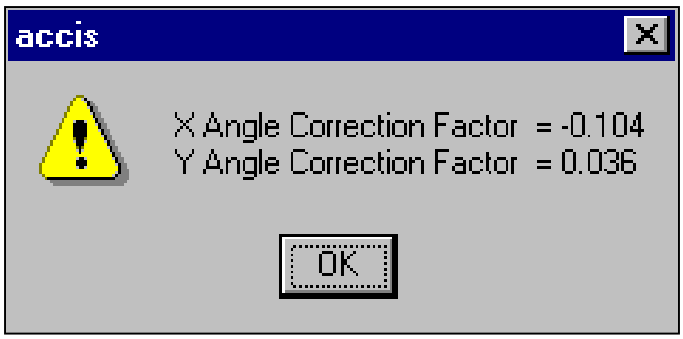
- The interferometer will go through a few scans to measure and map the surface of the connector.
- Occasionally, the Auto Focus may fail. If it does, adjust the focus knob to bring the fringe pattern into view and click RETRY. If it fails again, click on CANCEL to allow the interferometer to scan the entire region.

accis
Problem applying Autofocus. Please adjust focus to bring fringes back into view. Then click RETRY to perform Autofocus again, or click CANCEL to skip Autofocus and proceed to scanning.
Retry
Cancel

Step 18

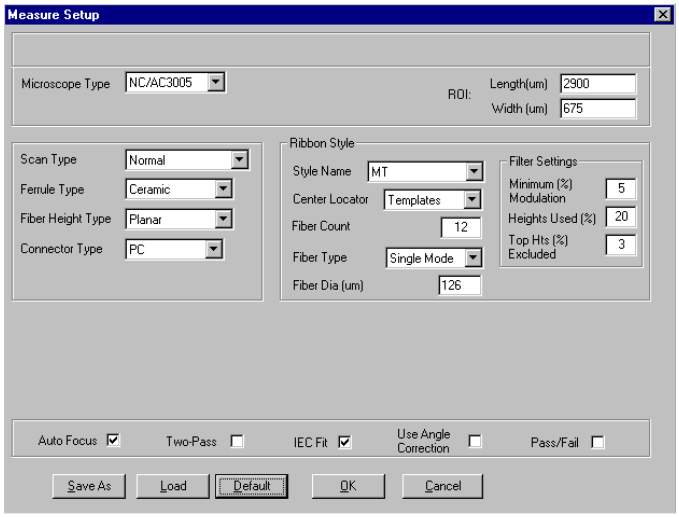
- When the second scan is completed, the X and Y Angle Correction Factors will be displayed.

- Click “OK”.



Step 19

- Click on “ F2 Set Up”
- Click on “Default”
- Change Style Name to the connector being measured, ie MiniMT or MT
- Click “OK”
- Perform One Pass w/ “Use Angle Correction” selected to measure connectors if faster measurement time and higher throughput are desired.



D. MT Reference Calibration Procedures

Step 1

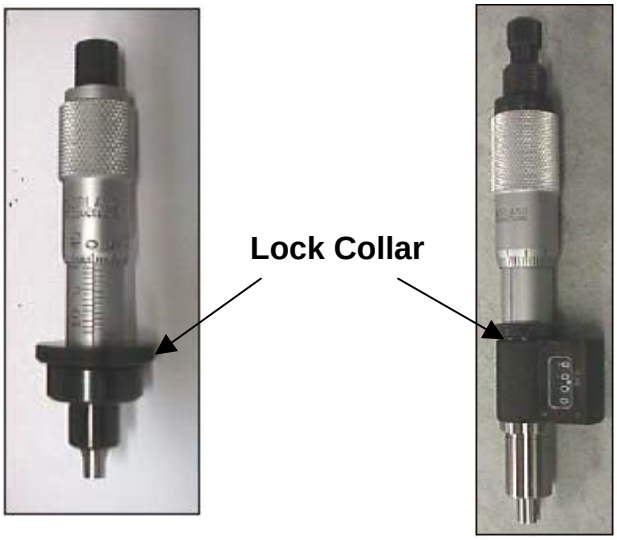
- Obtain the following:
  - Stainless Steel MT Reference (optional)
  - Computer and Monitor powered up with ACCIS software running.
  - NC/AC 3005 microscope unit
  - MT Edge Alignment Mount
  - Alcohol & Lint free wipes or the supplied connector cleaner

Step 2

- Wipe all oils/dirt/dust off the surface of the tilt stage with alcohol. (Picture A)
- Clean the bottom of the mount with alcohol. (Picture B)
- Using compressed air, blow off any dust/particles that may be inside the mount. (Picture C)
- Place the mount onto the stage and lock into place with the mount screws. (Picture D)

Step 3

- Verify that the lock collar is in the unlocked position by turning the lock collar counterclockwise.
- Set the micrometer to 0.0
  - Note: For the greatest accuracy and repeatability, final adjustments should always be done by turning the micrometer in a clockwise direction
- Turn the lock collar clockwise to lock into position.

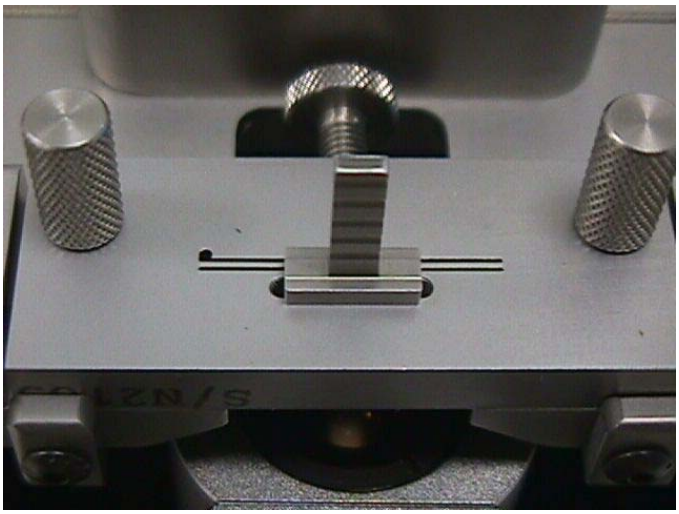


Step 4

- Clean the MT reference with the connector cleaner supplied.
  - Alcohol and a lint free wipe can be used instead of the connector cleaner if desired. Make sure any alcohol on the connector is wiped off before inserting the connector in the mount.
- Clean dirt/dust/oils off of the shoulder of the connector (the part that rests on the mount) so that it rests flush to the mount

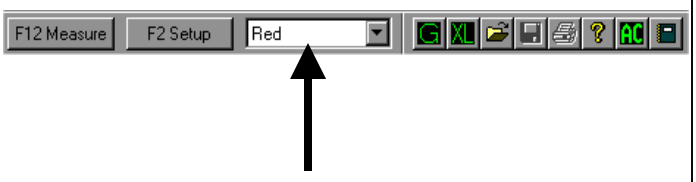
Step 5

- Insert the MT reference into the mount.
- Push all the way down into the mount by applying equal pressure on the left and right side of the connector.
  - If there is play between the mount and the connector, adjust the screw on the mount so the connector is held snuggly in place.
    - Mount should not be too tight as this may damage the MT reference when inserting/removing it.



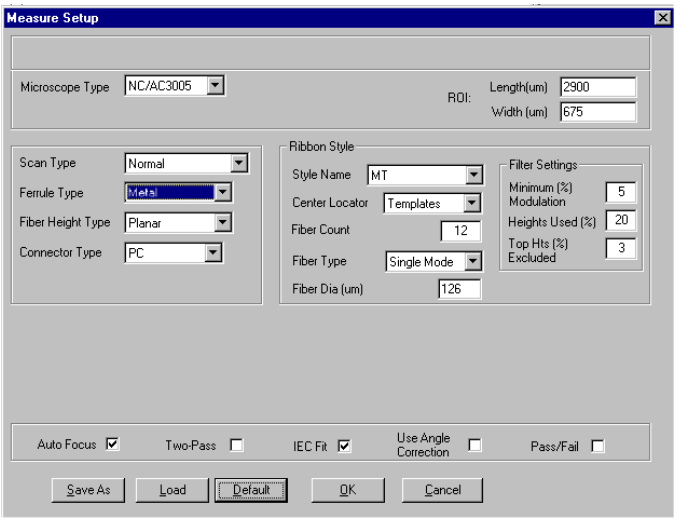
Step 6

- Change to Red Light mode if not already in it.



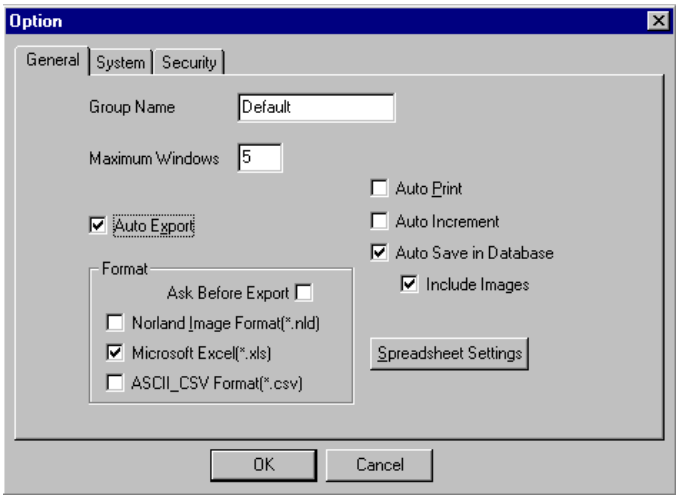
Step 7

- Go into the Set-Up screen by pressing the "F2 Setup" button on the Toolbar.
- Click "Default"
- Select Microscope Type: NC/AC 3005
- Change "Ferrule Type" to Metal.
- Click "OK" to save the parameters and exit the set up screen



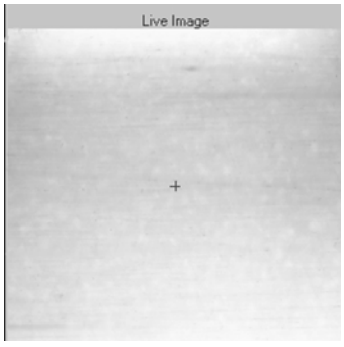
Step 8

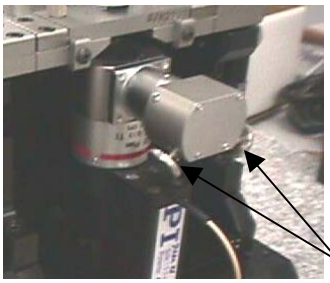
- Go into the Configuration → Option screen.
- Click on the General Tab
  - Enter Group Name and select auto save and auto increment if desired.
- Click OK to exit screen and return to the program.



Step 9

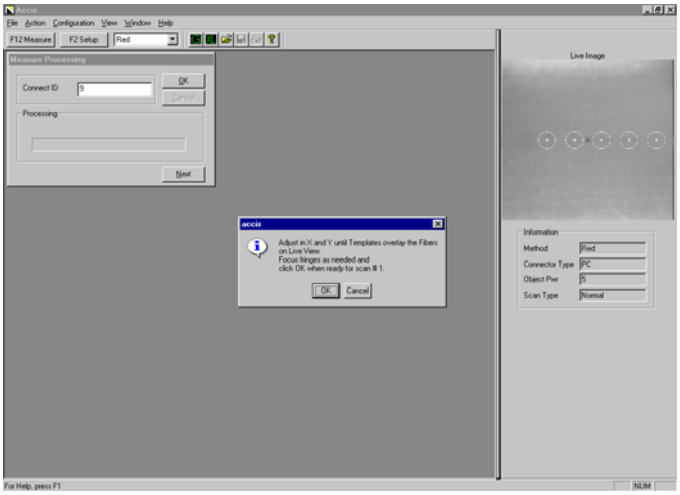
- Adjust the focus knob to bring the fringe pattern into the middle of the live image screen
- Adjust the mirror knobs one at a time to expand the fringe pattern so that there is only **one fringe** that covers the surface.
  - NOTE: The mirror is VERY sensitive to even the slightest movement of the mirror knobs, so be very gentle when turning them.





Step 10

- Press “F12 Measure” on the Toolbar or F12 on the keyboard.
- Follow the command prompt.
  - Since there are no fiber on the MT reference, lining up the fibers in the template does not have to be done.
  - Adjust the focus knob to bring the fringe pattern into the center of the live image screen.
  - Press OK
- If desired, the Connector ID can be changed while the scan is in progress. Click on OK after the Connector ID has been changed.
  - Make sure not to cause any vibrations.



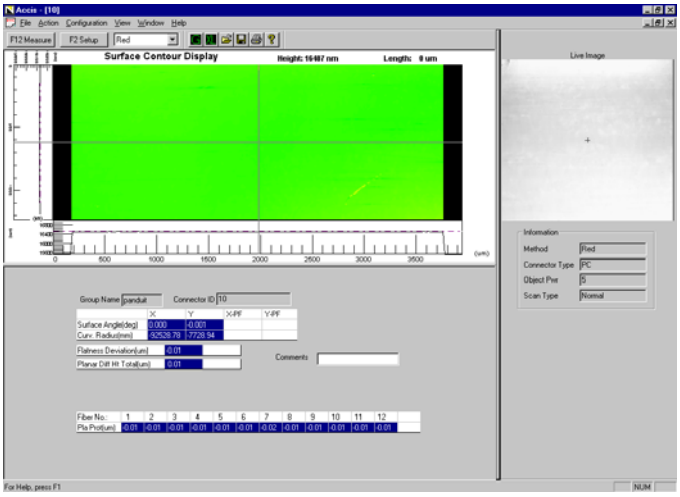
Step 11

- The interferometer will go through a few scans to measure and map the surface of the MT reference.
- Occasionally, the Auto Focus may fail. If it does, adjust the focus knob to bring the fringe pattern into view and click RETRY. If it fails again, click on CANCEL to allow the interferometer to scan the entire region.

accis
Problem applying Autofocus. Please adjust focus to bring fringes back into view. Then click RETRY to perform Autofocus again, or click CANCEL to skip Autofocus and proceed to scanning.
Retry
Cancel

Step 12

- Upon completion of the scan, verify that the End face Angle measurement in the X and Y direction is at least 0.01º.
  - If the measurements are not within the above spec, repeat steps 9-11.



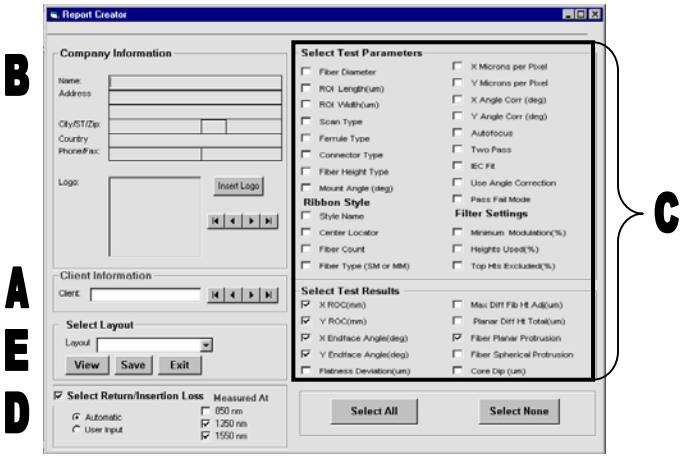
E. Report Generation

NOTE: Reports are generated from the data contained in a Microsoft Access database. To save data into the Microsoft Access database, "Auto Save in Database“ must be selected in the option dialog (Configuration\Option\General) before scanning. To generate a report, a layout must first be configured.

How to configure and save a layout…..

I. The user needs to create at least one report configuration in order to have a report layout to select at report printing time.

1. From the main ACCIS window pull down menu, select (Report\Configure).
2. A form will appear (as shown) into which the user can enter the name of a particular Client for whom this report format will be used. Into this form the user can also enter their Company information, including logo, and select which measurement data will appear along with the other entered information on the printed report.



A. Enter a Client Name in the "Client Information" section. If there are multiple Clients, enter a name and then click the single Right arrow button to move to a new blank record for entering a new Client Name. Repeat this process as needed.

- The four arrow buttons work as follows: Left and right buttons bring up the first and last entries, respectively. The middle-left and middle-right buttons cause a move to the previous and next entries, respectively, from the presently displayed record.

B. Enter Company Information in the "Company Information" section. Entries into this section work in a similar way to the "Client Information" section. In addition, the Insert Logo button can be used to select a disk file of either JPEG or BMP format to include as graphics on the printed report.

C. Select which data to present from the selection fields in the section titled "Select Test Results" and "Select Test Parameters".

D. Select which Insertion/Return Loss information should go into the report. If none desired, do not select this option in the Select Layout Section.

E. A particular report configuration can be saved to a Configuration Name by clicking the <SAVE> button in the Select Layout Section and entering a name (the report will contain the information showing on the screen at time of saving).

- Before saving, the user has the option to click the <VIEW> button to see how a printout of the currently selected configuration would look as a Portrait-oriented printout.

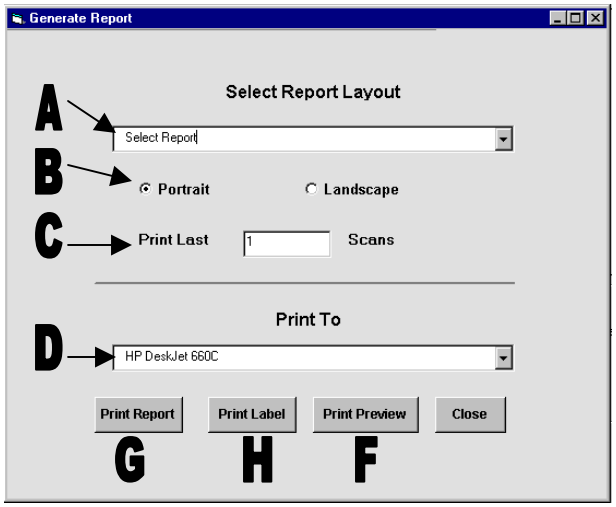
3. When finished creating and saving all report configurations, click the <EXIT> button.

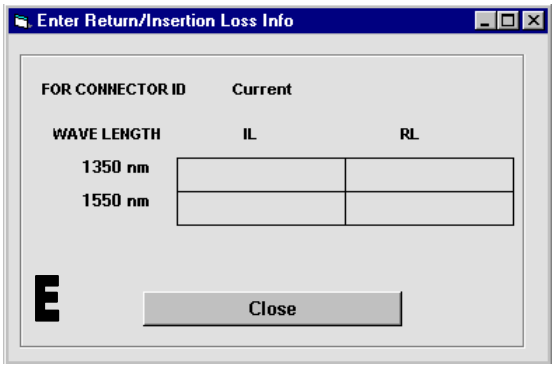
How to generate a report…..

1. Verify that “Auto Save in Database” is selected in Option dialog (Configuration\Option\General) When selected, the additional option of saving graphics into the database used as Report data source is presented. If graphics in the Reports are desired, select "Include Images".

2. Perform a connector scan, which makes data available for a report upon successful completion.

3. From the main ACCIS window pull down menu, select (Report\Generate) or click the Report Generate icon at far right on the main ACCIS window toolbar. (NOTE: Steps a, b, c & d only need to be done the first time a report is printed, or if a change is required later)….





   a. Choose a previously configured report layout in the PRINT REPORT selection field.

   b. If a standard printer has been selected, specify the desired printout orientation with the "Portrait" or "Landscape" radio buttons.

   c. Select the number of most recent scans to print.

   d. Select a printer to use in the PRINT TO selection field.

   e. Enter the IL/RL information for particular Connector when prompted. Report\Configure form has an option to manually enter the insertion loss and return loss for particular connector at the time of Report\Generate for the chosen wavelengths. Wavelengths available are 850 nm, 1300 nm, and 1550 nm.

   f. If desired, view how the report will look by clicking <Print Preview> button. When clicked a view of the report is generated. In the Print Preview screen, the Reports can be exported to Microsoft Word, rich text or pdf formats by selecting the export button on the Print Preview dialog displayed when the <Print Preview> option has been selected. When export button is clicked user can select the format and location to save the reports.

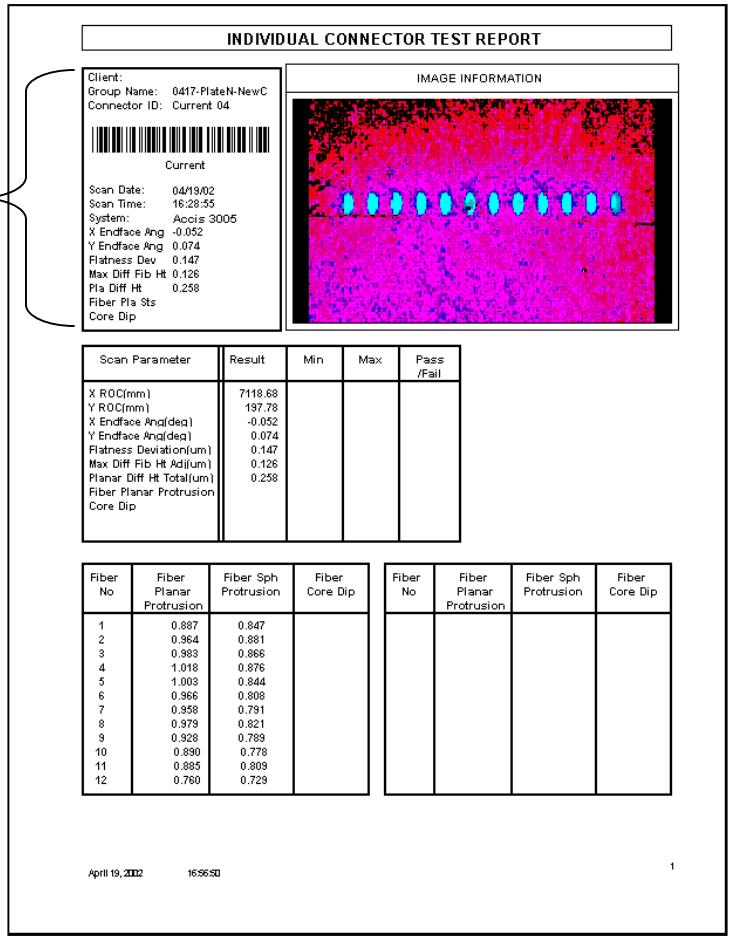
   g. If a printout to a standard printer is desired, click the <Print Report> button. When clicked a report is printed in portrait or Landscape mode of the most recent measurement with report format according to the chosen report layout

   h. If a printout to a label printer is desired, click the <Print Label> button. When clicked, this button causes only a label with company name and basic scan information such as Connector Id to be printed, with connector ID also coded and printed as a barcode.

   i. An example of the layout of the report is shown on the next page.

EXAMPLE of REPORT PRINT OUT created by using Report Configuration and Report Generation on the menu bar and on the toolbar

Label area as explained in step h on the preceding page.



INDIVIDUAL CONNECTOR TEST REPORT

Client:
Group Name: 0417-PlateN-NewC
Connector ID: Current 04

Current

Scan Date: 04/19/02
Scan Time: 16:28:55
System: Accis 3005
X Endface Ang -0.052
Y Endface Ang 0.074
Flatness Dev 0.147
Max Diff Fib Ht 0.126
Pla Diff Ht 0.258
Fiber Pla Sts
Core Dip

IMAGE INFORMATION

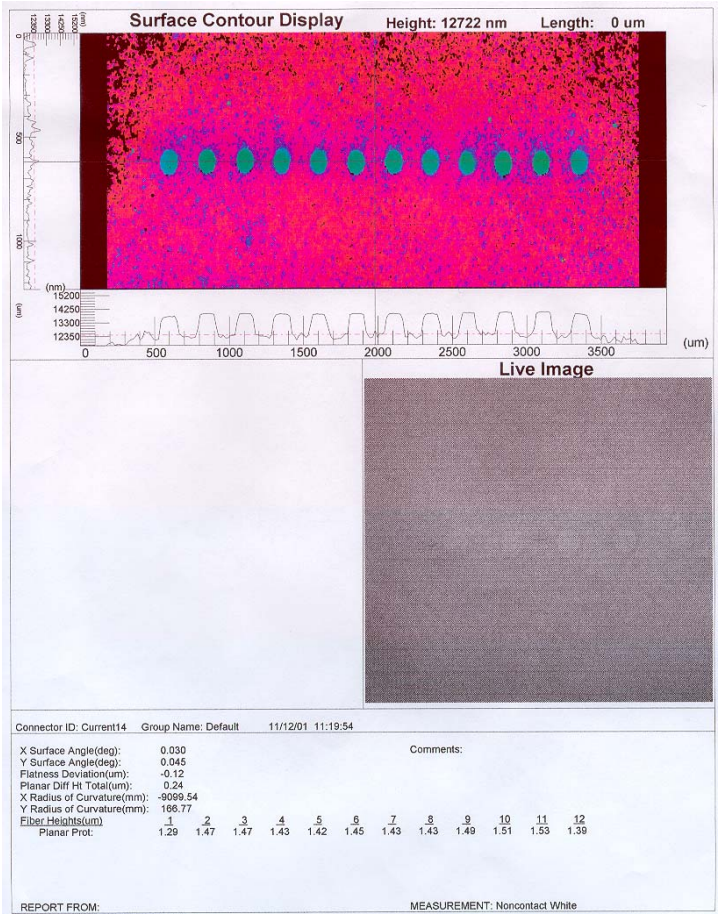
Scan Parameter	Result	Min	Max	Pass /Fail
X ROC(mm)	7118.68			
Y ROC(mm)	197.78			
X Endface Ang(deg)	-0.052			
Y Endface Ang(deg)	0.074			
Flatness Deviation(um)	0.147			
Max Diff Fib Ht Adj(um)	0.126			
Planar Diff Ht Total(um)	0.258			
Fiber Planar Protrusion				
Core Dip				

Fiber No	Fiber Planar Protrusion	Fiber Sph Protrusion	Fiber Core Dip
1	0.887	0.847	
2	0.964	0.881	
3	0.983	0.866	
4	1.018	0.876	
5	1.003	0.844	
6	0.966	0.808	
7	0.958	0.791	
8	0.979	0.821	
9	0.928	0.789	
10	0.890	0.778	
11	0.885	0.809	
12	0.760	0.729	

Fiber No	Fiber Planar Protrusion	Fiber Sph Protrusion	Fiber Core Dip

April 19, 2002 16:56:50 1

EXAMPLE of RESULTS PRINT OUT created by using print function on the menu bar and tool bar.



Surface Contour Display Height: 12722 nm Length: 0 um

(nm) 15200 14250 13300 12350

0 500 1000 1500 2000 2500 3000 3500 (um)

Live Image

Connector ID: Current14 Group Name: Default 11/12/01 11:19:54

X Surface Angle(deg): 0.030
Y Surface Angle(deg): 0.045
Flatness Deviation(um): -0.12
Planar Diff Ht Total(um): 0.24
X Radius of Curvature(mm): -9099.54
Y Radius of Curvature(mm): 166.77

Comments:

Fiber Heights(um)	1	2	3	4	5	6	7	8	9	10	11	12
Planar Prot:	1.29	1.47	1.47	1.43	1.42	1.45	1.43	1.43	1.49	1.51	1.53	1.39

REPORT FROM: MEASUREMENT: Noncontact White

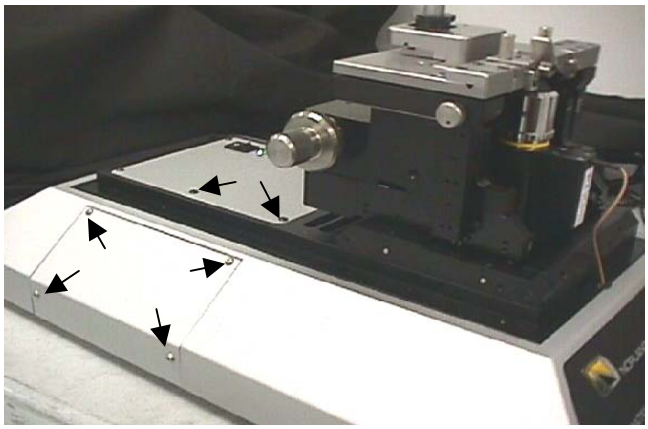
F. AC Bulb Replacement Procedure

Step 1

- Obtain the following:
  - 20 watt quartz halogen bulb
  - NC 3005 microscope unit powered off and allowed to cool.
  - A computer and monitor on with the ACCIS software running.
  - 1/16 Allen Key

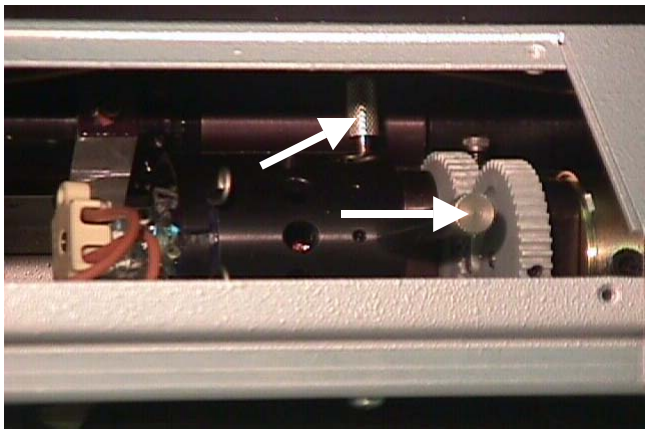
Step 2

- Remove the four allen head screws located on the left side of the microscope. And the four allen heads on the top of the microscope (only two of these are indicated in the picture).
- Lift off the cover plates and set aside.
- Allow the bulb to cool if still hot.



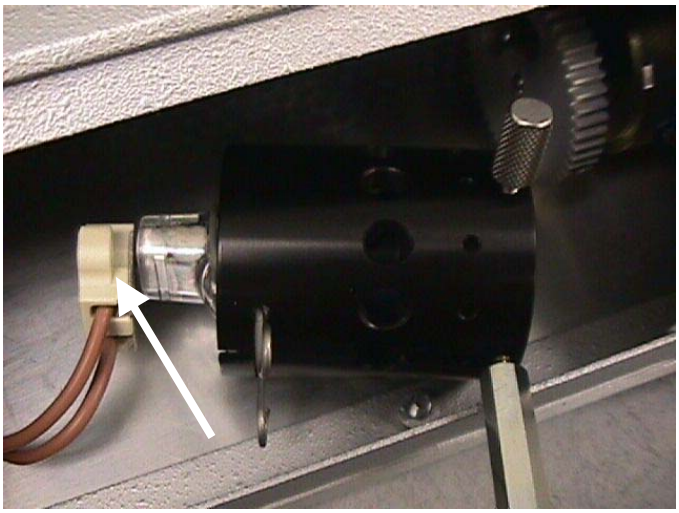
Step 3

- Loosen the two screws indicated in the picture.
- Carefully pull towards the back of the interferometer to release the lamp mount.



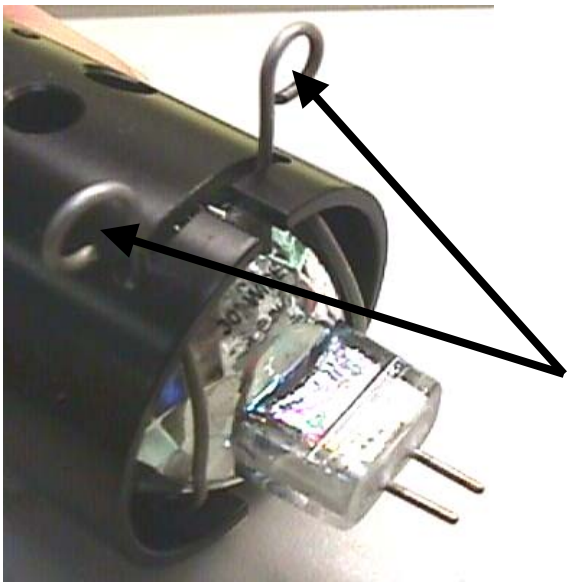
Step 4

- Remove the socket, indicated in the picture, from the bulb by rocking it side to side slightly.
  - Be very careful when removing. DO NOT yank the socket from the bulb.



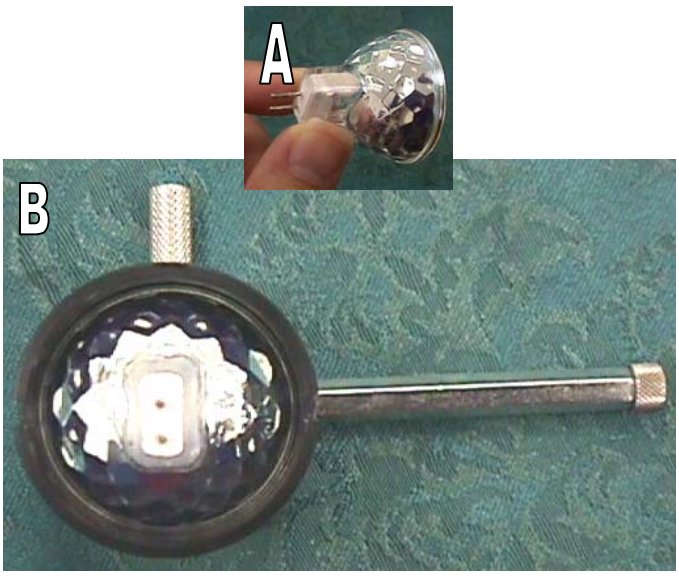
Step 5

- Remove the lamp clip that holds the bulb in place by squeezing the two ends indicated in the picture towards each other and then sliding out.
- Remove the bulb.



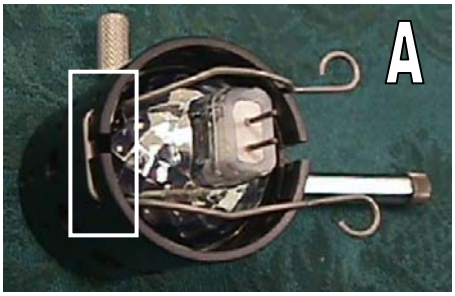
Step 6

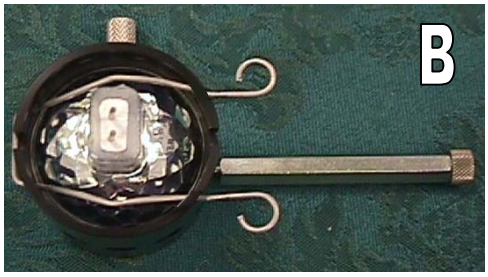
- Remove the new bulb from its packaging being very careful NOT to touch the inner portion of the bulb with bare fingers. Only handle the outer surface as shown in picture A.
- Lay the bulb mount onto the table on the side with the two screws.
- Place the bulb into the bulb mount as shown in picture B. (The prongs are orientated perpendicular to the long handle screw as shown in the picture.)



Step 7

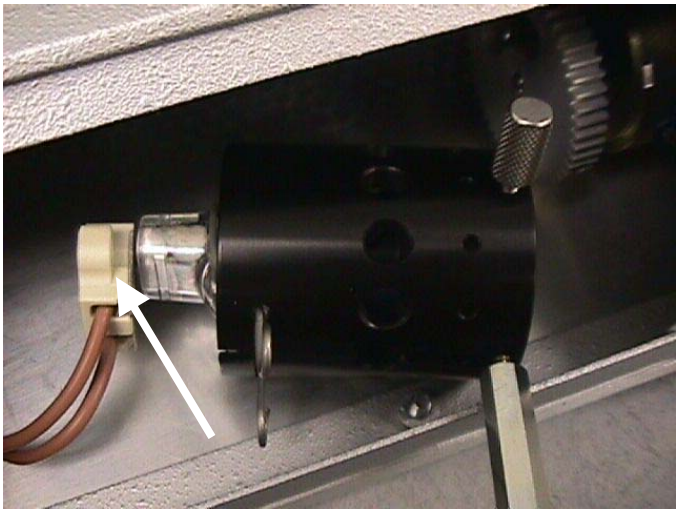
- Place the lamp clip back into position.
  - Insert the bottom of the lamp clip into the lamp mount in the area indicated by the box in picture A.
  - Insert the left and right ends of the lamp clip into the cut outs as shown by the arrows in pictures B.





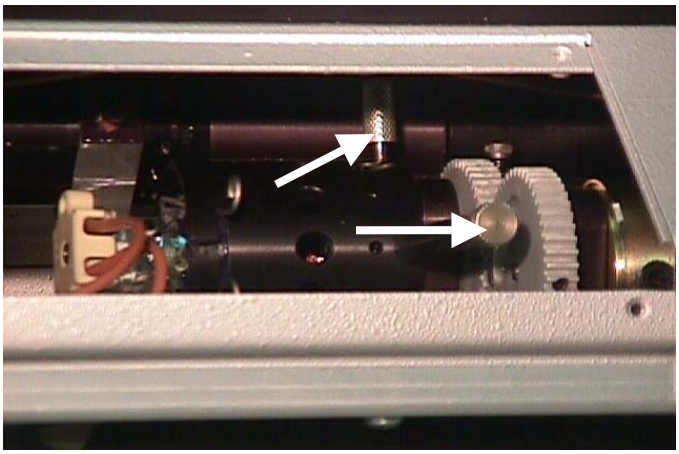
Step 8

- Carefully attach the socket to the prongs on the bulb by rocking it slightly side to side.



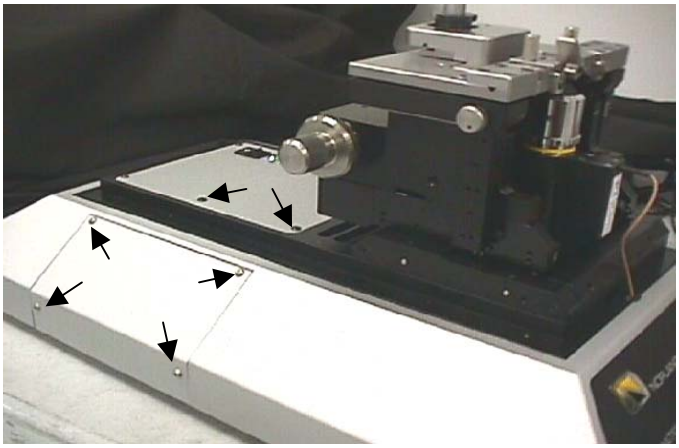
Step 9

- Place the lamp mount back into the interferometer in the same orientation when taken out.
- Tighten the two screws indicated in the picture.
  - Make sure that the lamp mount is securely in place.



Step 10

- Using the 1/16 allen key, reattach the left side panel and the top side panel on the interferometer with the 8 screws.
- Turn the interferometer on.

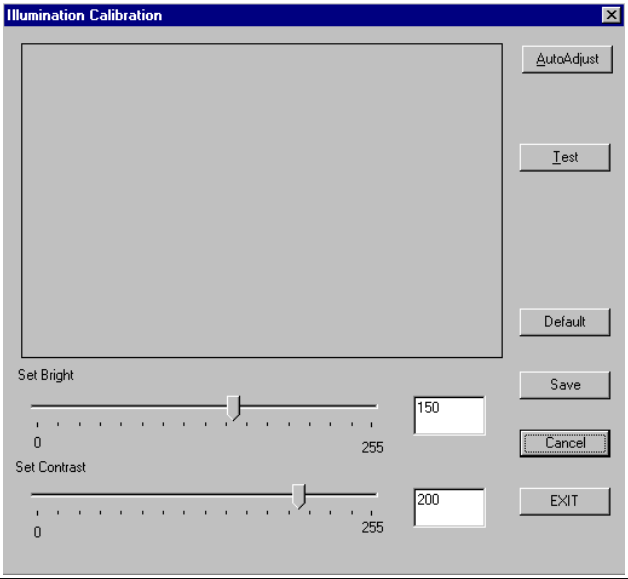


Step 11

- Place a connector into the mount and adjust the focus knob to maximize the fringe pattern.
- Look at the illumination in the red light mode and the white light mode.
  - Are the illuminations similar between the two modes?
    - If yes, bulb replacement is complete.
    - If no, proceed to step 12.

Step 12

- Select Red mode.
  - Go into the Action → Illumination Calibration and press “Auto Adjust”.
  - Click “Save” and “Exit” when auto adjust is completed.
- Repeat above for White light mode.



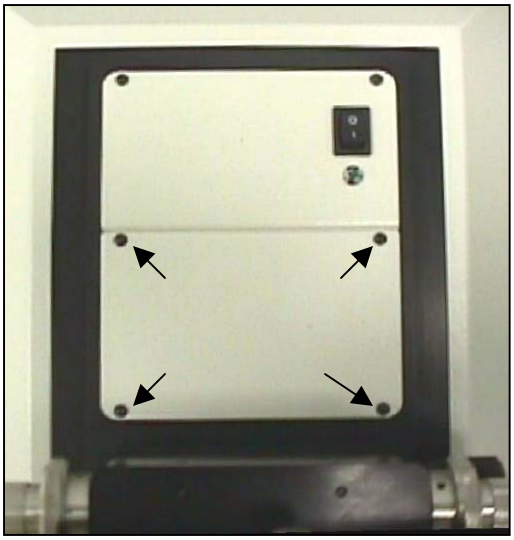
G. NC Bulb Replacement Procedure

Step 1

- Obtain the following:
  - 20 watt quartz halogen bulb
  - NC 3005 microscope unit powered off and allowed to cool.
  - A computer and monitor on with the ACCIS software running.
  - Rubber tipped tweezers supplied with unit
  - Flat Head Screwdriver

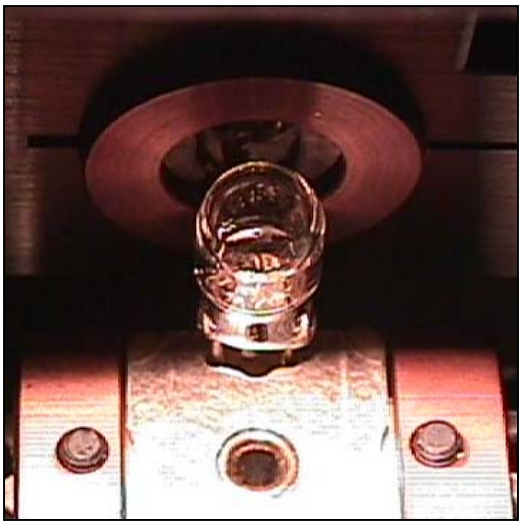
Step 2

- Remove the four allen head screws located behind the microscope stage.
- Lift off the cover plate and set aside.
- Allow the bulb to cool is still hot.



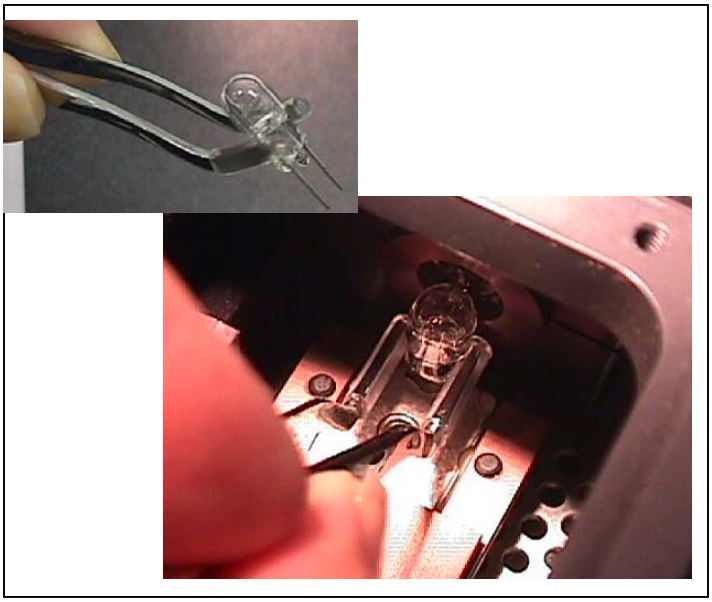
Step 3

- Note how the bulb is orientated in the socket. It is best to place the new bulb in similarly to how the old one is placed, which will decrease the amount of alignment needed later in this procedure.
- Using the rubber tipped tweezers, grab onto both sides of the bulb, and remove the bulb by pulling it straight up.
  - A slight rocking motion side to side may be necessary.



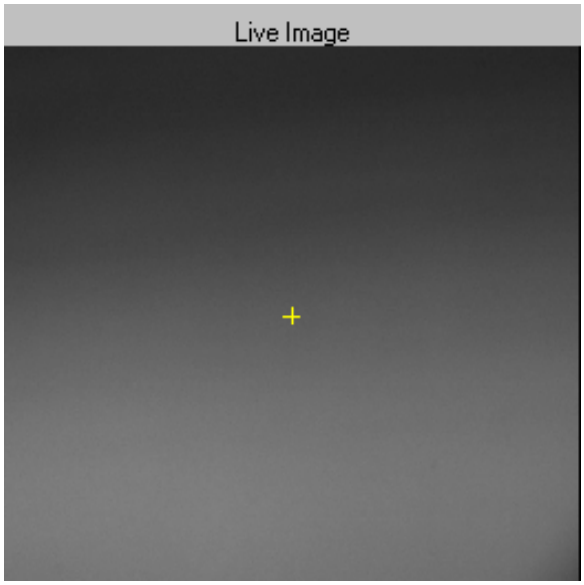
Step 4

- Remove the new bulb from its packaging being very careful NOT to touch the bulb with bare fingers.
- Using the rubber tipped tweezers, insert the two prongs of the lamp into the base, making sure that it is completely seated and orientated similarly to the old bulb.
- Turn the interferometer on.
- Double click on the live image to enlarge it.



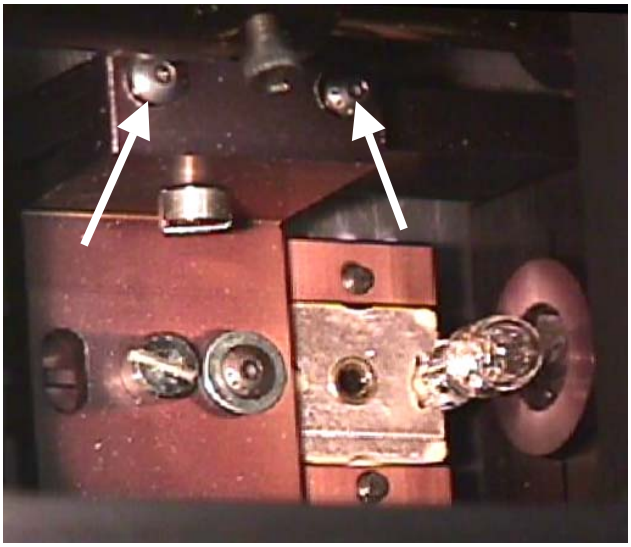
Step 5

- If the illumination seems uniform across the entire screen, move onto step 8.
- If the illumination is not uniform across the screen (as shown by the live image to the right), the lamp may not be seated correctly so adjust the position of the lamp on the stage slightly with the flathead screwdriver or tweezers (Please remove rubber tips from tweezers first. The bulb will melt the rubber.), until the illumination is uniform across the screen. If this does not work, move onto step 6.



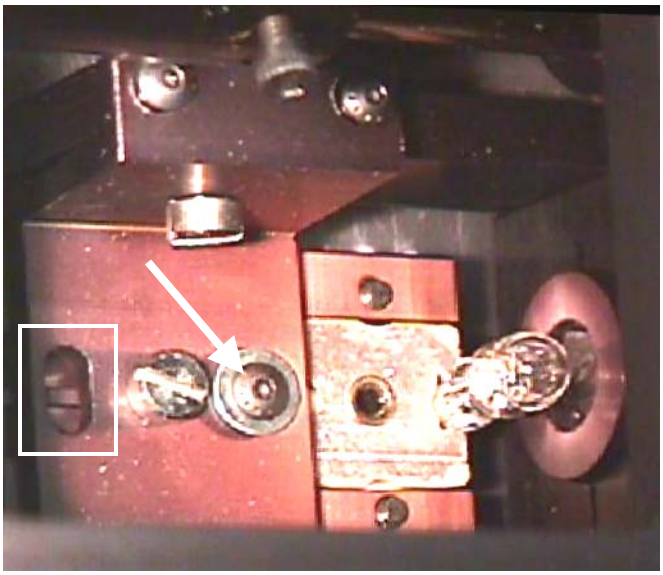
Step 6

- Using a 1/16” Allen wrench, adjust the two allen head screws at the lamp assembly indicated in the picture by the two arrows.
  - Loosening one slightly and tightening the other will move the lamp up or down on the screen.
- When the illumination is centered on the screen, tighten the two allen head screws set the stage in place.
  - Do not over tighten the screws so that the illumination is moved off center.



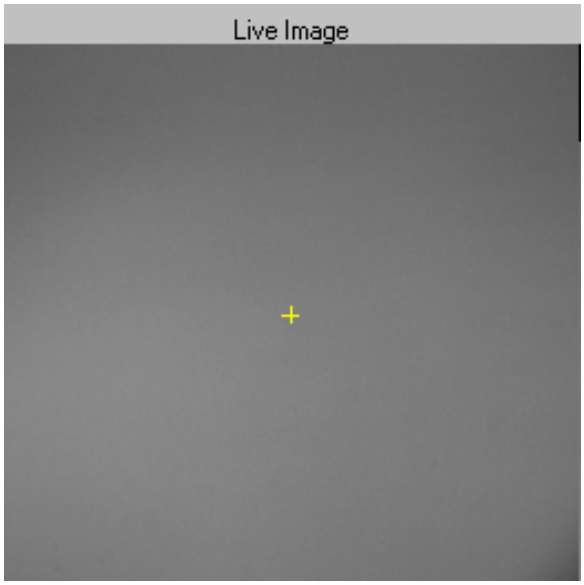
Step 7

- Using a 1/16” Allen wrench, adjust the one allen head screw in the lamp assembly as indicated by the arrow in the picture.
  - Loosen the screw slightly so that the stage is still snug, yet slight adjustments can still be made.
  - Move the stage side to side until the illumination is optimized on the screen. This can be done by using the flathead screwdriver in the box indicated in the picture.
  - When done, tighten the allen head screw making sure that the stage is not moved out of proper alignment.



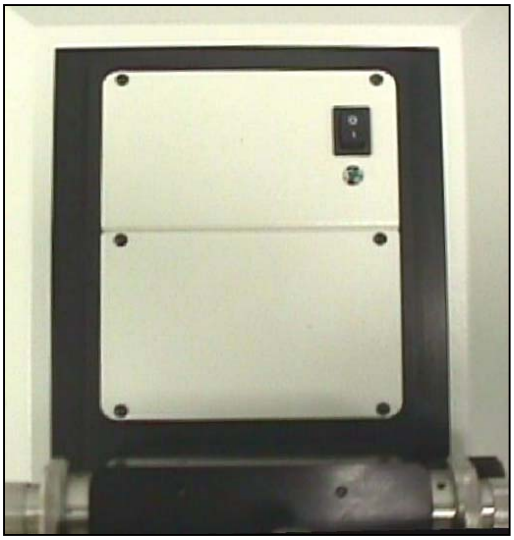
Step 8

- Repeat steps 6 and 7, or repositioning of the bulb until the illumination is uniform, as shown by the live image to the right.
- Screw the cover plate in place when replacement of bulb is completed.



Step 9

- Screw the cover plate in place when replacement of bulb is completed.
- Place a connector into the mount and adjust the focus knob to maximize the fringe pattern.

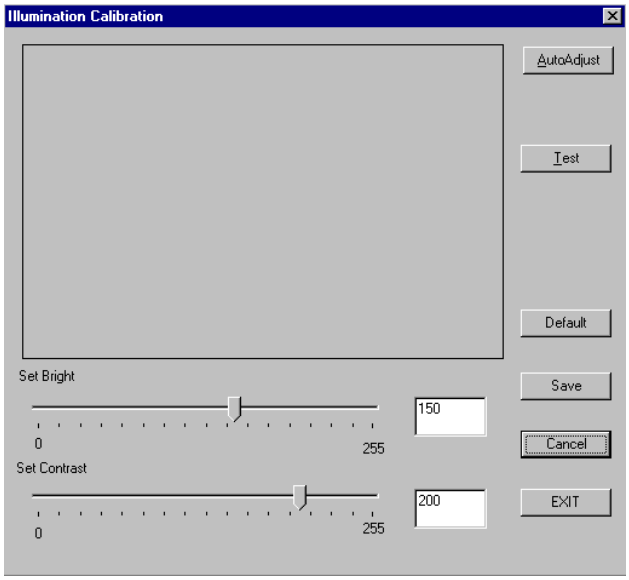


Step 10

- Look at the illumination in the red light mode and the white light mode.
  - Are the illuminations similar between the two modes?
    - If yes, bulb replacement is complete.
    - If no, proceed to step 11.

Step 11

- Select Red mode.
  - Go into the Action → Illumination Calibration and press “Auto Adjust”.
  - Click “Save” and “Exit” when auto adjust is completed.
- Repeat above for White light mode.



H. ACCIS Software Installation

The ACCIS software is already installed into the computer, although, if at any time, the software must be re-installed, follow the procedure below.

Software Requirements:

- Operating System: Microsoft Windows NT 4.0 or later
- Microsoft Office 2000 – Default Installation (At least Small Business)

Hardware Requirements:

- Intel Pentium III 550 MHz
- 64 MB SDRAM
- 80MB free disk space

INSTALLATION PROCEDURE:

1.Make sure the NIDAQ (National Instrument Data Acquisition hardware and associated drivers), and the frame grabber hardware are installed on your computer and are connected to the microscope.

2.Shut down any running programs.

3.Insert the ACCIS RC 3_0x Installation CD into your CD-ROM. If the set-up dialog does not start automatically do the following:

a. Click Start
b. Select Run
c. Type E:\Setup.exe (where E is your CD-ROM drive letter).
d. Click OK.

4.Follow the on-screen instructions.

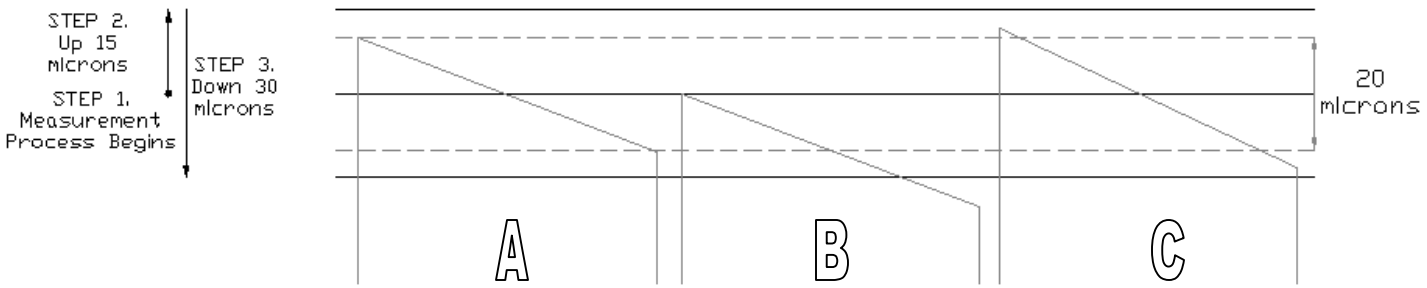
a. During the Microsoft Data Access Components Installation, a message box may appear suggesting you must restart the computer before the new settings will take affect, and giving you the option to reboot or not. **DO NOT REBOOT AT THIS TIME. Reboot the system only when the ACCIS installation is completely finished.**
b. When the software has finished installing, a dialog displays “The Installshield Wizard has successfully installed ACCISRC3_0x. Before you can use the program you must restart the computer, so select “Yes, I want to restart my computer now” and then click “Finish”.

I. FAQ's for the NC/AC 3005

What is the difference between red light and white light analysis?

The 3005 has the ability to analyze surfaces using either red light or white light. This gives the customer the maximum versatility for the system. The *Red Light or Monochromatic Light* mode uses Phase Shift Interferometry to measure smooth, continuous surfaces. A single wavelength of light is more coherent and causes interference over a wider range so that fringes will appear over the entire surface being analyzed. The interferometric objective is only moved a short distance to determine the direction in which the fringe pattern shifts. This is a much faster measurement but is limited to measuring step heights which are 1/4 of the wavelength of the light source being used. With red light at a wavelength of 650 nanometers, the system is limited to step heights of 162.5 nanometers or less.

The *White Light or Broadband Analysis mode* uses Phase Scanning Interferometry to measure rough surfaces with varying step heights. White light has a lower coherence and provides an interference pattern with only a few fringes visible on the surface to be measured. The White Light mode shifts the interferometric objective to scan the surface from the highest point on the connector to the lowest. The fringe pattern at the beginning of the measure function needs to be positioned approximately at the middle of the connector using the focus knob, which can be done by focusing the fringe pattern in the middle of the live image screen. After the measure function is started, the objective moves up approximately 15 microns so that the fringes are off the surface and then scans a distance of 30 microns down as shown by connector A in the illustration below. The software is capable of measuring a connector with a maximum surface height differential (the highest point to the lowest point of the surface of a connector) that occupies up to 20 microns of the total 30 micron scan range for auto-focus to work correctly. If auto-focus fails, the fringe pattern may not have been set to the middle of the connector as shown in connector B where the fringe pattern is focused on the highest point of the connector or the surface height differential of the connector may be larger than 20 microns as shown by connector C.



How does the 3005 system handle wide connectors larger than the field of view?

With a field of view of 1560 microns, the 3005 is able to map the region of interest for a MiniMT ferrule in a single scan. For larger surfaces such as MT ferrules, the system uses Multiple Image Overlay software which programs it to scan one section of the connector then automatically traverses to the next section. After the complete surface has been analyzed, the multiple sections are combined into a complete image of the connector. The field of view is optimal for providing detailed information of the individual fibers as well as the entire region of interest. This is extremely versatile as fiber counts expand to multiple rows, because the system is capable of measuring up to 6 rows high of fibers. No other system has this versatility.

How does the system find the fibers on the connector?

The 3005 system is different from all other systems in that it can measure connectors with the fibers flat polished, protruded or recessed in the connector. The system is programmed to find the fibers with the knowledge that they are symmetrically spaced from the center of the ferrule. By having the operator align on an initial feature such as the guide hole or the fibers on one side of the ferrule, this provides the information needed to find the fibers across the entire connector.

How does the system measure fiber protrusion?

With “IEC FIT” selected in the Set Up menu, the 3005 follows the IEC/TIA fiber optic test procedure for multifiber end face measurements. Fiber protrusion is typically desired for most connectors to perform their best. It calculates the best fit plane for the defined Region of Interest using 20% of the highest points across the surface. The fiber protrusion is the perpendicular distance from this plane to the center of the individual fibers. See the appendix for more details on the IEC/TIA test procedure.

If “IEC FIT” is not selected in Set Up then the best fit plane is calculated from all the points across the surface.

How does the system measure the angle of polish?

The IEC/TIA procedure requires that the angle of polish for the connector be measured in reference to the plane perpendicular to the average of the two guide hole axis. The 3005 uses our patented True Angle Connector Mounts which use integral guide pins for holding the connectors in alignment. The pins are held on a precision aperture plate at the bottom of the mount which allows for viewing of the connector in the region of interest. Inserting the connector simply requires sliding it into the mount and onto the guide pins. No other system on the market today is as simple or easy to use. This is similar to the alignment of two connectors that are being mated on a bulkhead or in a termination. Aperture plates are also available with holes for connectors with pins so all ferrules and connectors both male and female, flat or angled can be measured.

What needs to be calibrated in the system to assure accurate measurements?

To calibrate the machine to accurately locate the center of the connector, it is recommended to perform a Magnification Calibration/Auto Calibration procedure to assure that the correct magnification calibration factor is being used. A Magnification Calibration Standard is supplied with the system. A NIST Traceable Magnification Calibration Reticle is an optional item that can be used for greater accuracy and assurance.

If measuring APC connectors, it is recommended to perform a 0º-8º Calibration procedure to assure that the micrometer controlled variable tilt stage accurately tilts to 8º. A NIST traceable 0º-8º flat is used during this procedure.

To calibrate a Pin Alignment mount to the interferometer, it is recommended to perform an End Face Calibration. An End Face Calibration adjusts the mirror and determines the X and Y Angle Correction Factors in order for the optical path to be perpendicular to the reference surface. Once the correction factors are stored, a One Pass w/ "Use Angle Correction" measurements can be done.

To calibrate an Edge Alignment mount to the interferometer, it is recommended to perform an MT Reference Calibration. This calibration procedure adjusts the mirror in order for the optical path to be perpendicular to the flat reference surface. Once the calibration procedure is completed, One Pass w/OUT "Use Angle Correction" measurements should be done.

For more information please refer to Chapter 5.

Which mounts do I need to use to measure connectors?

Pin Alignment - The latest IEC and TIA test procedures recommend measuring the angle of the multifiber connector using the guide holes of the connector as the reference with the ideal end face perpendicular to the axis of the guide holes. This is accomplished with the patented True Angle Connector Mounts from Norland Products which use integral guide pins for holding the connectors in alignment. The pins are held on a precision aperture plate at the bottom of the mount and allows viewing of connector in the region of interest. Inserting the connector simply requires sliding it into the mount onto the guide pins. This is very similar to the alignment of two connectors that are being mated in a bulkhead or in a termination. Aperture plates are also available with holes for mounting connectors with pins.

Edge Alignment - These mounts align the ferrule by using the outside edges of the ferrule similar to the way that they are held in the polishing process. The entire ferrule end face is in view and the surface can be mapped from guide hole to guide hole. Since the ideal end face should be perpendicular to the guide hole axis, this method assumes that the outside edges are parallel to the guide holes. Edge alignment mounts provide greater stability for ferrules which have stiff cables attached to them.

What is the difference between the print command and the report generation command?

The print command prints all data and surface displays of the connector measurement. Report generation allows the customer to configure the data as desired and only print what is needed. The reports contain user preferred test results, company information, client information, Insertion and Return Loss information, 3D image and live image of the connector, as well as a Barcode representing the Connector ID for that particular scan. This barcode is in a section of the report, which on specially made printout forms, can be peeled off of the report for labeling a bag used for the tested connector. The forms are supplied by Norland Products.

Refer to Appendix – Report Generation for more detailed information.

How do I know if the reference mirror is adjusted correctly?

The positioning of the reference mirror in the interferometer is integral in order to obtain accurate angular measurements of the end face of a connector. To obtain accurate angular measurements the mirror must be adjusted so that it is parallel to the "ideal" end face of a connector. This "ideal" end face is the plane perpendicular to guide holes/pins located on the connector as illustrated in figure 1. (Note: Figure 1 is a side view representation of a connector.)

Adjustments of the mirror can be done on the NC/AC 3005 with the two mirror screws indicated in figure 2. The mirror pivots at three points – one stationary pivot at the top of the mirror and two pivots towards the bottom (which are controlled by the two mirror screws), therefore both the X and Y positioning will change by turning either of the mirror screws.

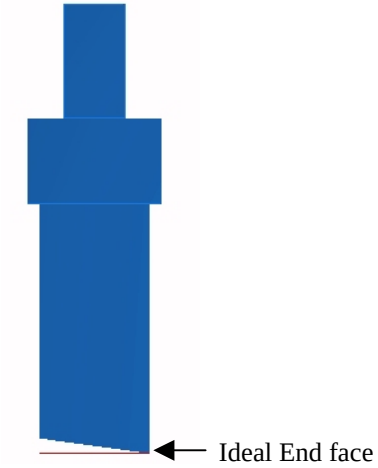


FIGURE 1

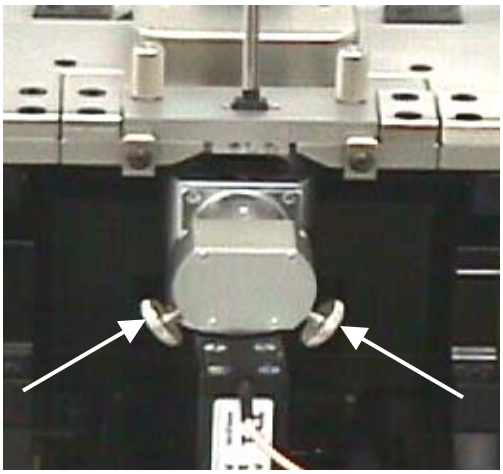


FIGURE 2

"How does one know that the mirror is correctly adjusted so that it is parallel to the "ideal" connector end face?" The answer to this question is dependent upon the method selected to measure the connector end face. The NC/AC-3005 offers two measurement methods: One Pass and Two Pass. (NOTE: Procedures for One Pass and Two Pass are explained in detail in Chapter 6 of the manual.)

The One Pass method can be done using either the Edge Alignment mount or the Pin Alignment mount (both explained further in the Novel Features section of this chapter). With the Edge alignment mount, the "ideal" connector end face can be determined using the Stainless Steel MT reference or any other connector that is known to be almost perfectly flat. The MT reference has been created so the end face is almost perfectly flat and perpendicular to the vertical edges, thus acting as the "ideal" end face. The mirror screws should be adjusted one at a time to expand the fringes over the entire end face. To familiarize yourself with how the mirror is adjusted with the mirror screws, it is best to turn the mirror screws one at a time. It is easiest to turn one mirror screw in the direction in which the fringe pattern expands (stopping before it begins to contract) and then repeating the same process with the other

mirror screw. Figure 3 is an example of the fringe pattern that should be obtained using the Stainless Steel Reference with one fringe over the entire area of the live image. Figure 4 is an example of the fringe pattern that should be obtained using a flat connector with the fringes over the entire area of the live image.

The One Pass method using a Pin Alignment mount should only be used after completing a End face Angle Calibration (as explained in detail in Chapter 5 of the manual) to obtain the angle correction factors. After completing the End face Angle Calibration, the mirror screws should not be adjusted.

The Two Pass method is very similar to the End face Angle Calibration and should only be used with a Pin Alignment mount. The mirror screws are adjusted only on the first connector being measured so that the fringe pattern is the same in both the front and back orientations of the epoxy well on the connector. With the fringe pattern the same in both the front and back orientations, the mirror is adjusted to the "ideal" connector end face. The mirror screws should not be adjusted after this. Figure 5 is an example of the fringe patterns that should be obtained in both the front and back orientations of the connector.

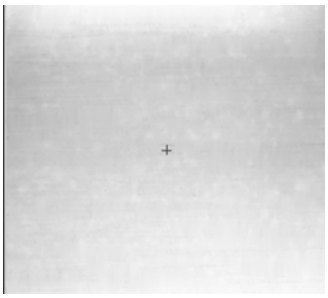


FIGURE 3

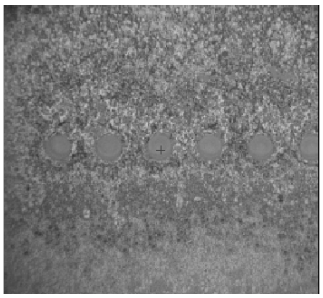
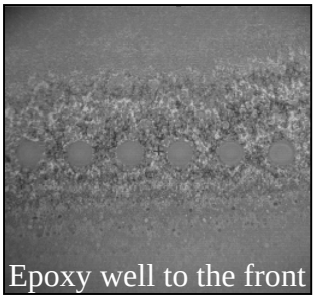


FIGURE 4



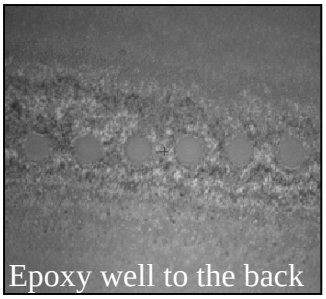


FIGURE 5

Can a Bar Code Scanner be used with the ACCIS software?

Yes, the software can be used with bar code scanners that are compatible with a Keyboard Wedge device. The bar code scanner and the keyboard are plugged into the keyboard wedge device, which is then plugged into the CPU's keyboard connection. The information resulting from the scanning of a bar code symbol is treated by the PC or terminal as if it originated from the keyboard, while the keyboard itself remains fully functional. Because the terminal or PC cannot differentiate between bar coded data and actual keyboard data, a keyboard wedge interface allows bar code reading capability to be rapidly added to an existing computer without changing the application software.

What is Fiber Masking? What are some advantages of Fiber Masking?

Fiber Masking is a feature of the ACCIS software that allows the user to choose individual fiber locations and some surrounding ferrule to be excluded from all surface analysis after the connector surface has been entirely mapped. This versatile feature is helpful when measuring connectors that have different fiber configurations than the standard connectors in the industry. Fiber Masking is controlled under Configuration/Connector in the menu bar of the software.

ADVANTAGES:

- Prevents QC testing failure for fiber optic connectors.
  - •By masking the unfilled fiber regions, Fiber Height and related measurements such as Differential Fiber Height and Adjacent Maximum Differential are not compared to Pass/Fail parameters and will not fail due to the missing fibers.
  - •Ferrule curvature, Flatness Deviation, Endface Angle, and Fiber Height measurements do not include the region where ferrule erosion may occur during the polishing process, therefore measurements more accurately represent the connectors performance when mated to other connectors.
  - •Endface Angle measurements remain consistent with results from a standard MT scan.
- Flexibility – allows testing for a wider range of non-standard connector designs.
- This method still treats the overall ferrule as one object and so may more accurately represent its performance when mated.

PARTS LIST **(Pricing and other parts can be found on the Norland Products website www.norlandproducts.com)**

TRUE ANGLE CONNECTOR MOUNTS			
Mounts with pins			
P/N	Description		
B801208	Mini MT- Aperture Plate w/pins		
B801210	MT - Aperture Plate w/pins		
B801212	MT-RJ – Aperture Plate w/pins		
B801214	MPX Aperture Plate w/pins		
B801220	MTP/MPO – Aperture Plate w/pins		
Mounts with holes			
P/N	Description		
B801207	Mini MT- Aperture Plate w/holes		
B801209	MT - Aperture Plate w/holes		
B801211	MT-RJ – Aperture Plate w/Holes		
B801213	MPX – Aperture Plate w/holes		
B801219	MTP/MPO – Aperture Plate w/holes		
EDGE ALIGNMENT FERRULE MOUNTS			
P/N	Description		
A801189	MT Mount		
B801188	MiniMT Mount		
CALIBRATION TOOLS			
P/N	Description		
A801126	Magnification Calibration Standard		
A801131	NIST Traceable Magnification Calibration Reticle		
A801129	0° MT Metal Reference		
A801110	NIST Traceable 0°/8° Tilt Calibration Standard		
OTHER ACCESSORIES			
P/N	Description	P/N	Description
25545	Black and White 9” monitor	A801007	Replacement 20 W Bulb for NC System
27100	Vibration Damping Table	A800567	Replacement 20 W Bulb for AC System
300-02-02	Microscope Controller Cable	A800100	Microscope Shipping Kit
A800315	120V Power Supply for 12 V Microscopes	B800759	Microscope Piezo Safety Cover
STRESS RELIEF ASSEMBLIES			
A801199	Cable Support		